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CONCORD SHOPS—BOSTON & MAINE RAILROAD.

Descriptions of this plant were begun in our February issue, page 37, and continued in the March issue, page 73. They are published simultaneously in the "American Engineer" and the "Railroad Gazette" by special arrangement.

Boiler Plant.

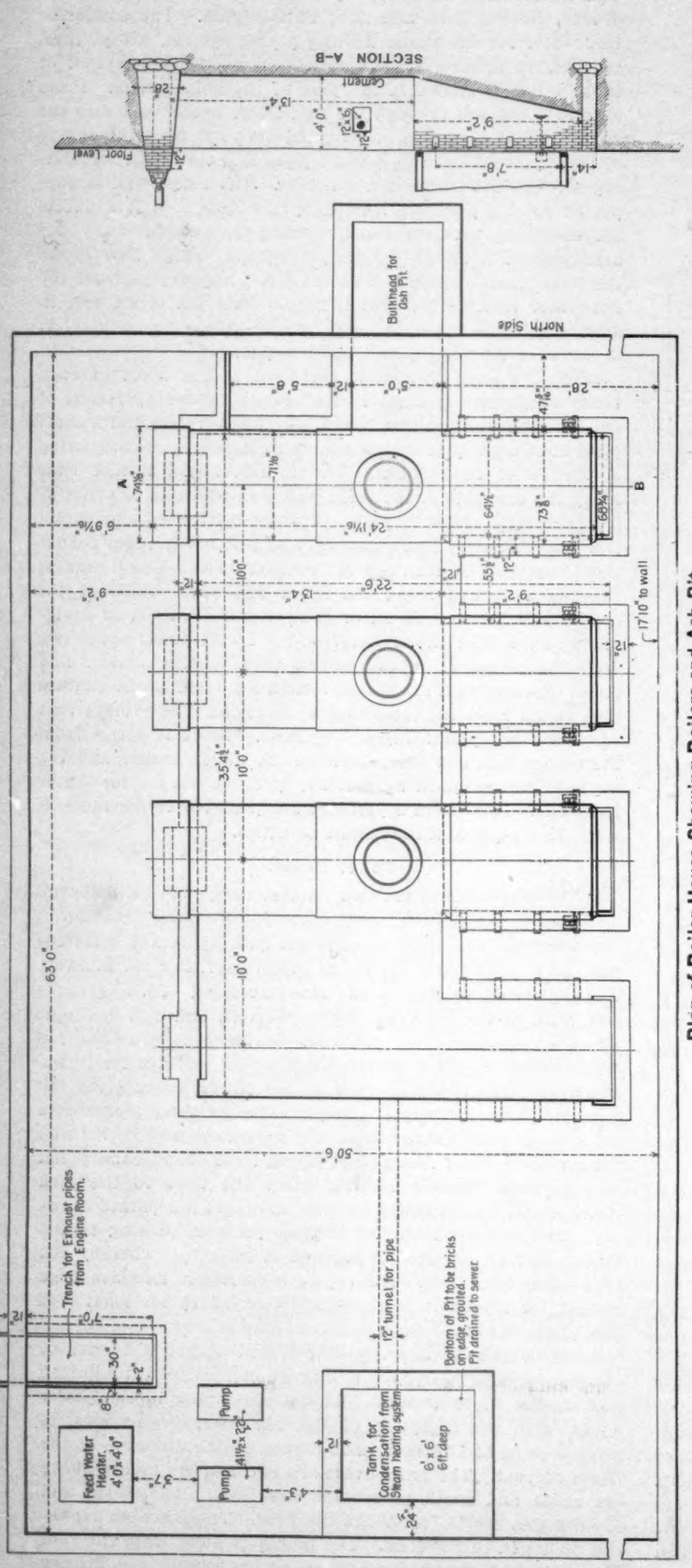
The boiler house is 65 by 50 feet in size and situated as shown in the inset accompanying the first article on the shops. (See our February issue). One roof covers the boiler and power house, the two being separated by a brick wall through which the steam mains pass. There are three locomotive type radial stay boilers with spaces for two more and an ashpit for a fourth when it shall be needed. The boilers are 70 inches in diameter in the barrel, and are built for a working pressure of 180 pounds. The smokebox end is supported upon a swinging link and the fire box end stands over a bricked-up pit. The boiler room has a cement floor and the pits under the boilers are arranged to admit small iron dumping carts under the fireboxes to receive the ashes. The pits are shown in section in the plan view of the boiler room. The space under the front portion of the boilers is excavated to a depth of four feet and a five-foot trench passes from this excavation under the north wall of the building for removing the ashes by means of a hoist that raises and loads them upon cars. The excavation is large enough for a week's accumulation of ashes. At the boiler fronts a space of 17 feet 10 inches is provided and in this a trestle is built for running coal cars directly into the boiler house and delivering the coal at the furnace doors.

The boilers each have a total heating surface of 1,834 square feet, the grate area is 40 square feet, and the tubes are 14 feet long. They connect to transverse breeching, which leads to a 70-foot stack. The smoke passes through an induced draft smoke fan driven by a direct connected engine, and its bearings are cooled by a circulation of water. The boilers are fed by two seven and a half by five by six-inch duplex outside plunger, brass fitted Deane (Holyoke) pumps, each of which is capable of feeding all of the boilers. Water is taken either from the "700 H. P." Cochrane feed water heater situated in the corner of the boiler room as shown in the plan or it may be taken from the city mains. This feed water heater takes the exhaust from the engines in the power plant and a direct exhaust discharge is provided to the roof for use if necessary. The heater was furnished by the Harrison Safety Boiler Works, Germantown Junction, Philadelphia. The condensation water for the whole heating piping system, except from the heaters themselves, is returned to the brick hot well or tank, which is shown in the plan of the boiler room. From here it is pumped through the feed water heater and into the boilers. This tank also receives the drainage from the engine receiver jackets and the exhaust pipes and the water circulating through the smoke fan bearings. The smoke fan is supported upon a platform framed by old rails, and it connects the breeching with the stack, causing an induced draft. Its arrangement is shown in the photograph, which also shows the large exhaust pipe and at the left a vapor pipe from the hot water tank to the roof is seen. This fan is six feet in diameter, and is driven by a five by four-inch double engine. It is rated for 750 horse-power boiler capacity.

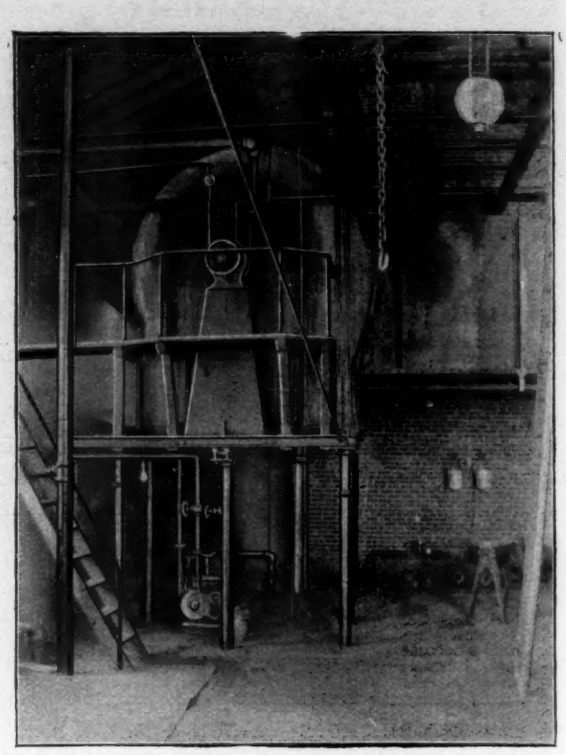
From the steel nozzles at the front of the dome of each boiler connection is made to the 12-inch header by means of two six-inch wrought iron bends, with angle valves and a short piece of straight pipe between them as shown in the engraving of the boiler connections. The 12-inch steam header runs along the east side of the brick partition wall and is about 65 feet in length, blank Ts being provided for the attachment of two more boilers. From both ends of this boiler room header short upright 10-inch pipes connect with 8-inch mains running westward along the north and south walls of the engine and dynamo room, or "power house," as it is designated on the inset already referred to. In the power house two six-inch cross-over pipes connect these engine mains, and these, together with the mains, form a loop, and as the engines take steam from the cross-over connections it is evident that the mains are practically in duplicate. There is a rise from the boilers and two more between the boiler header and the engines, but to guard against any possible chance for water to reach the cylinders separators are placed between the six-inch cross pipes and the engine throttles.

Power House.

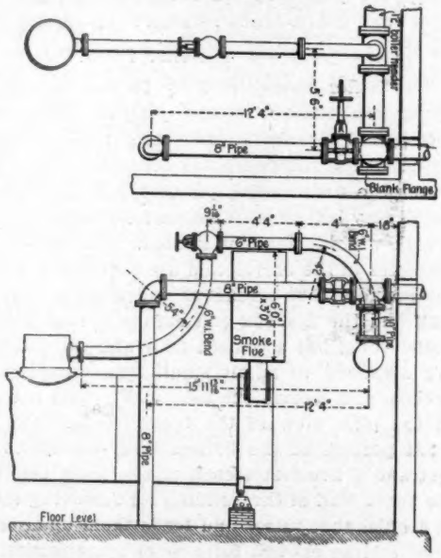
In the power house are two tandem compound "Fitchburg" 200 horse-power engines, a 100 horse-power simple "Standard" Westinghouse and a 125 horse-power Armington and Sims engine, an 8 by 12 Rand duplex air compressor, two 150 kilowatt Westinghouse Electric and Manufacturing Co.'s generators, with exciters, a 50 arc light (Weston) and a 35 arc light (Weston) dynamo, and considerable space is provided for future additions to the plant. This is also provided for in the steam piping. The plan view of the power house gives the location of the machinery; the plan view of the piping shows the arrangement of the mains, the separators and valves and the arrangement of the exhaust piping from the Fitchburg and Westinghouse engines leading under the floor to the feed water heater in the boiler room is shown in a separate drawing. The exhaust from the engines joins in passing to the heater, and an out-of-door exhaust is provided, whereby the heater may be cut out. This piping is carried in trenches large enough for a man to work in and covered by sectional cast iron plates made for easy removal. The exhaust from the air compressor and the Armington and Sims engine is carried to the planing mill heater, or it may be discharged through the roof during warm weather. The steam piping in the power house, with the exception of the cross-over connections, is given a slope of 1-16 inch in 12 inches, in the direction of the steam current. The cross-overs are two feet six inches above the north and south mains and are level. The north and south mains are 13 feet above the floor. There are no expansion joints in this system. The piping is hung from the roof trusses by roller hangers, and all of the piping and fittings are made extra heavy, with a view of a possible future increase in the working steam pressure. All of the fittings and valves above four inches in diameter are flanged, the flanges being grooved with tool marks to hold the packing, which is



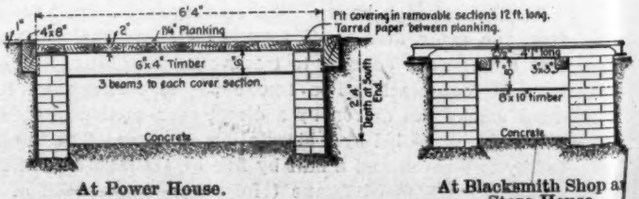
Plan of Boiler House Showing Boilers and Ash Pit.



Smoke Fan Located over Steam Pumps in Boiler House.



Connections from Boilers to Header.



At Power House. At Blacksmith Shop and Store House.

Sections of Steam Pipe Trenches.

CONCORD SHOPS—BOSTON & MAINE RAILROAD.

of the "Rainbow" brand, manufactured by the Peerless Rubber Manufacturing Co., throughout the plant. The exhaust pipes through the roof are provided with exhaust heads, of which there are three, one twelve-inch, one seven-inch and one six-inch.

The engines furnished by the Fitchburg Steam Engine Co., of Fitchburg, Mass., are of the tandem non-condensing compound type, with automatic cut-off and four valves. They have girder frames. The high pressure cylinders are 13 inches and the low pressure 22 inches in diameter, the stroke being 30 inches. They run at a speed of 125 revolutions per minute, taking steam from a four-inch pipe and exhausting into an eight-inch pipe. The fly wheels are 11 feet in diameter and have 31-inch faces, each taking a 26-inch belt for the generators and a three-inch belt for the exciters. The main bearings are 7½ inches in diameter by 16 inches long, and are filled with Babbitt metal and have adjustable side boxes to take up wear. The crank and crosshead pins, piston and valve rods are of steel, the connecting rods are of scrap iron, with hard bronze bearings for the crank and crosshead pins. The valves are of the balanced, expansible piston type, with positive adjustment of diameter to take up all wear that may occur during the life of the engines. The steam valves are double-ported and are actuated by a wrist plate cam motion, giving good regulation under the most abrupt changes of load. The exhaust valves are at the bottom of the cylinders, draining all water, and they are operated by an independent eccentric, giving free opening without altering the compression at the end of the stroke with changes of load. The engine bed is very heavy, and the crosshead shoes have a large area. Each engine has a steam jacketed receiver, connected between the cylinders. The engines are to regulate within 1½ per cent. from no load to full rated load and vice versa, no matter how abrupt the change in load may be.

The 100 horse-power Westinghouse engine is used to run the arc light dynamos, both of which run at a speed of 820 revolutions per minute. Its location and the connections for steam and exhaust are shown in the engravings. The 125 horse-power Armington and Sims engine, located in the northwest corner of the power house, runs the planing mill, as was explained in the second article. It is thought that one electrician with two assistants, one engineer and one fireman for day work and one for night will be able to operate and care for the power plant, and this does not increase the force above the number of men formerly employed for the purpose in the old shop plant, which was a very much smaller one.

The air compressor was furnished by the Rand Drill Co. It is an 8 by 12 inch duplex "Class B" steam air compressor, and is so designed as to permit of disconnecting either air cylinder if desired. The main frames are of the Corliss type, and are bolted to the cylinders by means of strong studs and faced nuts. No Babbitt metal is used about the machine, the pistons are solid and fitted with snap rings. The air cylinders are jacketed for cooling water, which is conveyed by pipe to the hot water reservoir in the boiler room for use as feed water for the boilers. The compressor has the Meyer adjustable cut-off valves, and it is regulated to a pressure of 100 pounds of air by a pressure governor. The fly wheel is solid and weighs 2,000 pounds. The weight of the complete machine is 6,500 pounds, it is 12 feet 5 inches long, and four feet eight inches wide, its capacity is 195 cubic feet of free air per minute, pumped against a pressure of 100 pounds.

Generators.

Besides the two arc light machines there are two generators in the power house supplying power for the motors. These are wired so that power and incandescent lamps may take current from both or one may run the lights, while the other operates the motors. The latter arrangement is necessary, owing to the dimming of the lamps while raising a heavy locomotive on the cranes if the lamp and motor circuits are combined. These generators furnish power for all of the motors enumerated further on in this description. They were furnished by the Westinghouse Electric and Manufacturing Co., each with a capacity of 150 kilowatts at 440 volts. They are of the two phase alternating type, the construction being shown in the engraving. Each alternating dynamo has a 5.62 kilowatt field exciter driven at a speed of 1,400 revolutions per minute by a narrow belt from the engine belt wheel. The electric plant includes one No. 2, a No. 6, a No. 8, a No. 12, two No. 16 and two No. 100 converters. The electric crane circuits are wired for a maximum of 200 amperes at 440 volts, the transfer table takes 60 amperes at 440 volts and all of the other motor circuits are 440 volts each. The incandescent lighting at the shops is done by a 440 volt current transformed to 104 volts, while that at the Concord station and in the Young Men's Christian Association building, about a half mile from the shops, is transformed from 440 to 1,000 and then down to 104 volts. Besides about 30 arc lights at the passenger station and others in the yards, these are used in the erecting, machine and boiler shops, the blacksmith shop and all of the buildings except the lumber shed, dry house and paint store house. The arc lights are spaced 50 feet apart for inside and from 150 to 200 feet apart for outside lighting. There are about 450 incandescent lamps at the station, freight house and round house, and about 300 in the various shop buildings.

The general appearance of the generators furnished by the Westinghouse Electric and Manufacturing Co. is shown by the accompanying illustration. The lower half of the field casting and the supports of the bearings constitute a single casting, insuring accurate centering of the armature. The field poles are of soft laminated steel, cast into the field yoke or frame. The magnetic circuit is of ample section to prevent saturation. The bearings are self-aligning and self-lubricating and the bearing surfaces are unusually large. A special grade of soft steel is used in building up the armature core, and the methods of construction avoid injury to the steel, which would increase losses due to magnetization. The armature coils lie in slots and are held therein by means of retaining wedges of hard fibre, driven into notches near the top of the slots, longitudinally with the armature. No band wires are used and both core and winding are thoroughly ventilated. The field and armature coils are wound upon moulds or formers and thoroughly insulated before they are put in place. Machines of this type operate at moderate speeds, which is a feature of great practical value.

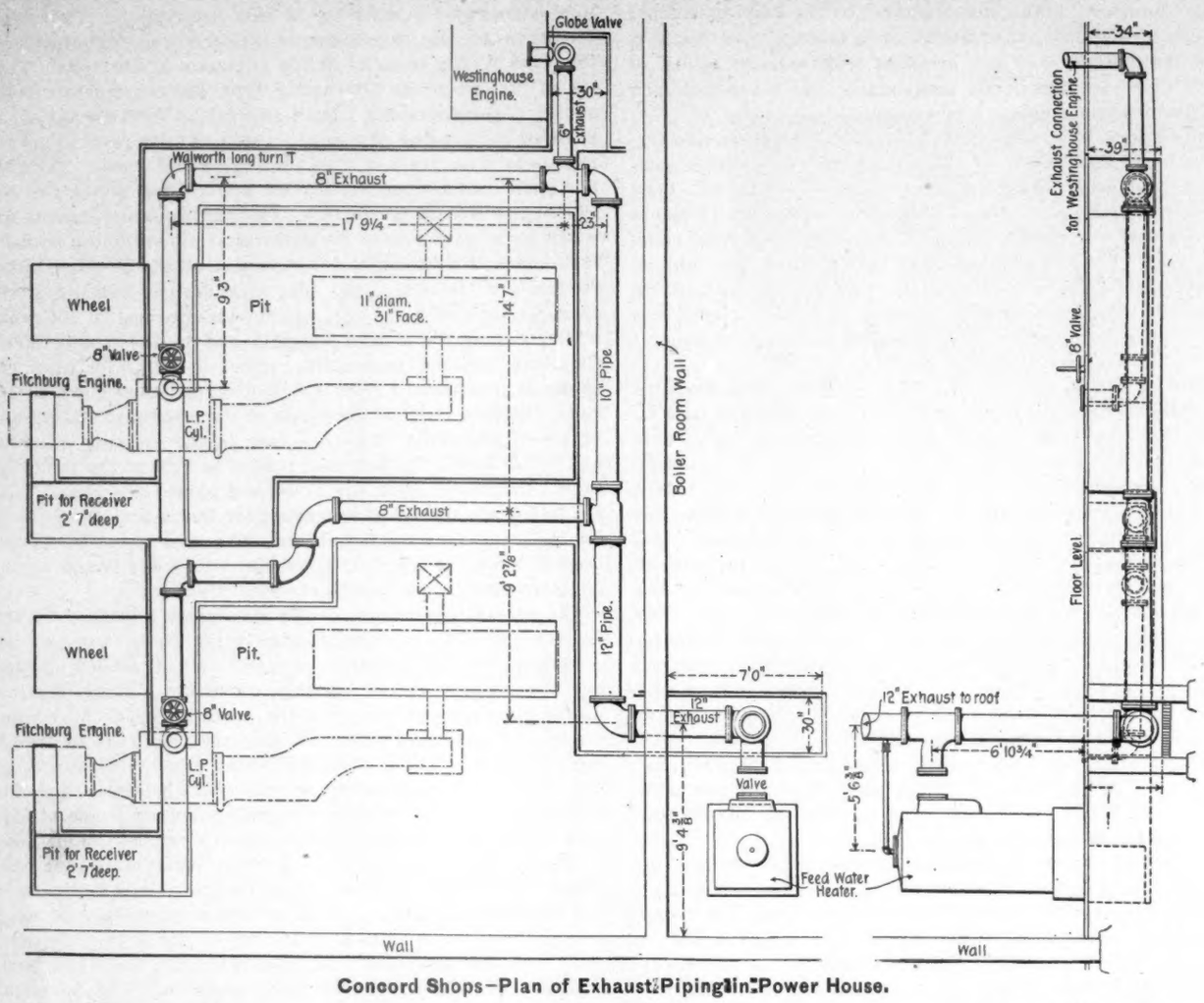
The switchboard has an iron frame, supporting five marble panels, with indicating and switching devices for the dynamos. The transmission of the currents for lights and motors is over a wire system strung on a pole line through the shop grounds.

Motors.

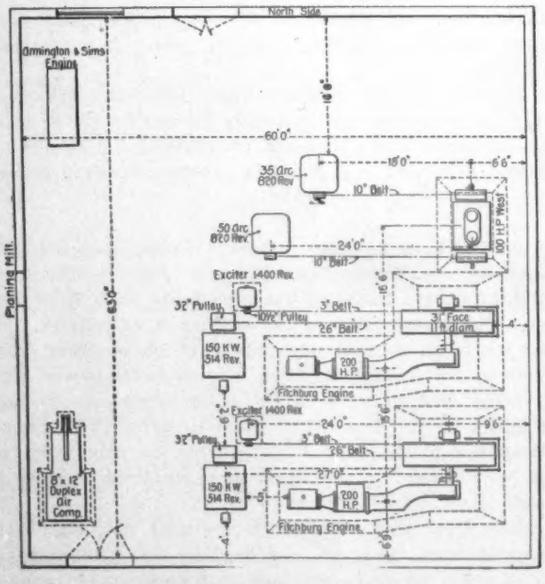
The shop motors are the Tesla Polyphase Induction type, furnished by the Westinghouse Electric and Manufacturing Co., running on 400 volt, two phase currents, with 7,200 alternations. The distribution of the motors is as follows: One 30 horse-power on the east side and one 20 horse-power on the west side of the locomotive shop, one 20 horse-power motor on the large bending rolls in the boiler shop, one 15 horse power motor in the blacksmith shop to drive the fans, one 20 horse-power in the same shop to drive the machinery, one 5 horse-power motor in the small shop buildings, besides the crane and transfer table motors.

The alternating current motor is specially well adapted to this kind of work, and the type used in this installation is worthy of study by those who are soon to be called upon to equip railroad shops with electric transmission. The interest which is taken at this time in electric motors demands a rather complete description, the information for which is furnished by the manufacturers.

The form of the motor is shown in the illustration. It will be noted that from a mechanical standpoint, this motor is reduced to the simplest possible elements, i. e., a stationary part permanently connected to the main circuits, and a rotating



Concord Shops—Plan of Exhaust Piping in Power House.



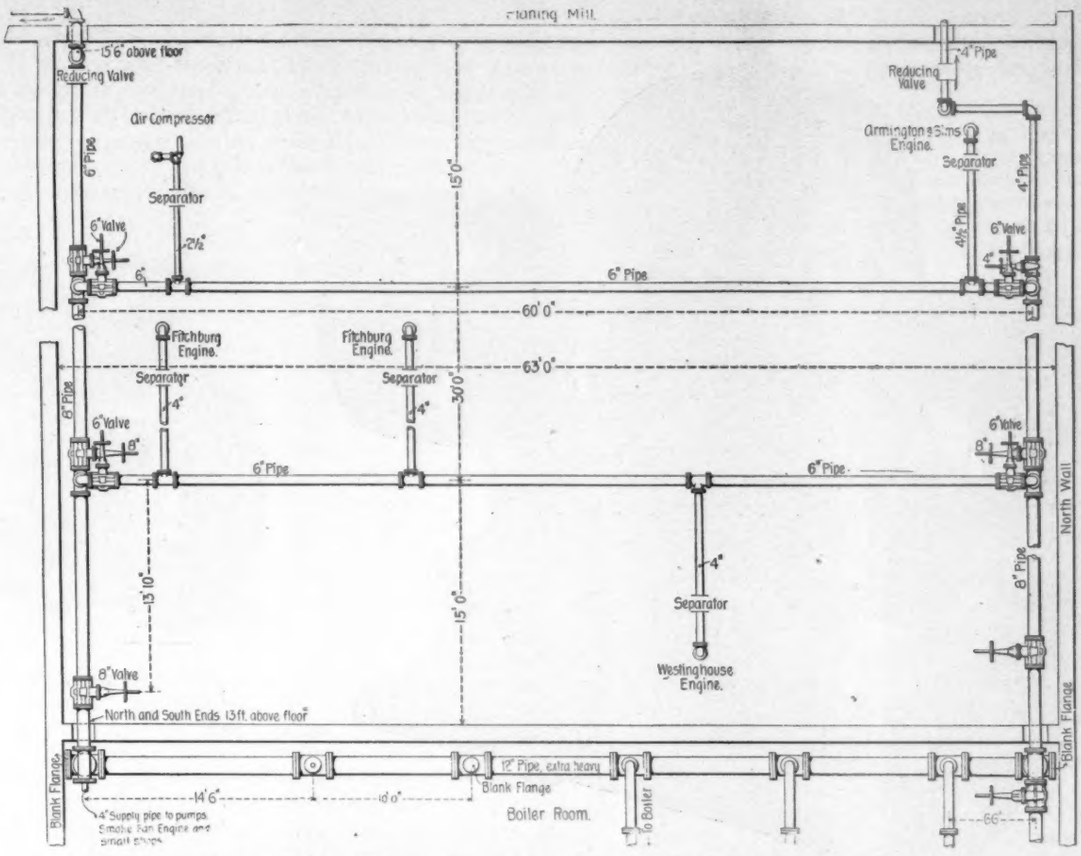
Engine and Dynamo Locations.

part having no electrical connection with any other, and absolutely no electrical contacts or adjustments; in fact, no sliding or working friction except that of the shaft in the journals. The only parts that can wear, therefore, are the shaft and journal boxes. The friction in these is very slight, on account of the light weight of the rotating part. Ample self-oiling bearings provide for liberal lubrication. It will, therefore, be observed that as a piece of moving machinery, the motor is designed and built to operate for long periods of time with but a very small amount of attention. These are known as "Type C" motors.

The hollow cylindrical frame of cast iron, in which the primary is mounted, forms a base for the machine and also supports the two end brackets carrying the self-oiling bearings. Perforated iron plates fitted into these brackets, both protect the rotating element and permit excellent ventilation. They may be replaced by solid plates when it is desired to make the motor absolutely dust-proof. It will be noted that the housing completely encloses the primary and secondary elements and protects them from any external damage.

The primary element consists of a hollow cylinder built up of laminated sheet iron rings, slotted on the inside to receive the conductors. These rings are rigidly supported by the cast iron housing which encloses the primary. The conductors are machine wound coils, which are thoroughly insulated before being placed on the core. The terminal blocks which are located on top of the machine are connected to the primary winding by leads which pass through the housing.

The design and principles governing the construction of the type "C" motor are fortunately favorable to the maintaining of a high and almost constant efficiency from full load to one-half load. Under the conditions which prevail in a very large proportion of electric motor service the motors are operated much of the time at considerably less than their full rated capacities. With this motor, therefore, by maintaining a constant efficiency, it is possible to secure an all day or average efficiency very much above that heretofore possible, with either direct or alternating current motors. The variation of speed between no load and full load is small, being less than that



Concord Shops—Plan of Steam Piping in Power House.

found in direct current motor practice, as determined by exhaustive tests.

A polyphase induction motor may be started by connecting it directly to the circuit with an ordinary switch. Small motors are so started in practice. The larger motors are started on a reduced voltage, the full E. M. F. of the circuit not being applied until the motors have reached a considerable speed. The fact that in a four-wire two-phase circuit different E. M. F.s exist between different pairs of wires, affords an easy way of obtaining the necessary reduction in E. M. F. For some classes of two phase and for three phase service the reduction of voltage is effected by a device called an auto-converter. This device is entirely separate from the motor itself. It is possible, by the use of the auto-starting device, to adjust a motor after installation to have any desired starting torque within very wide limits. Thus, a motor operating machinery having great inertia may be made to give a correspondingly strong starting torque, while one driving a very light device may be adjusted for extremely small starting torque, with a coresponding reduction in starting current.

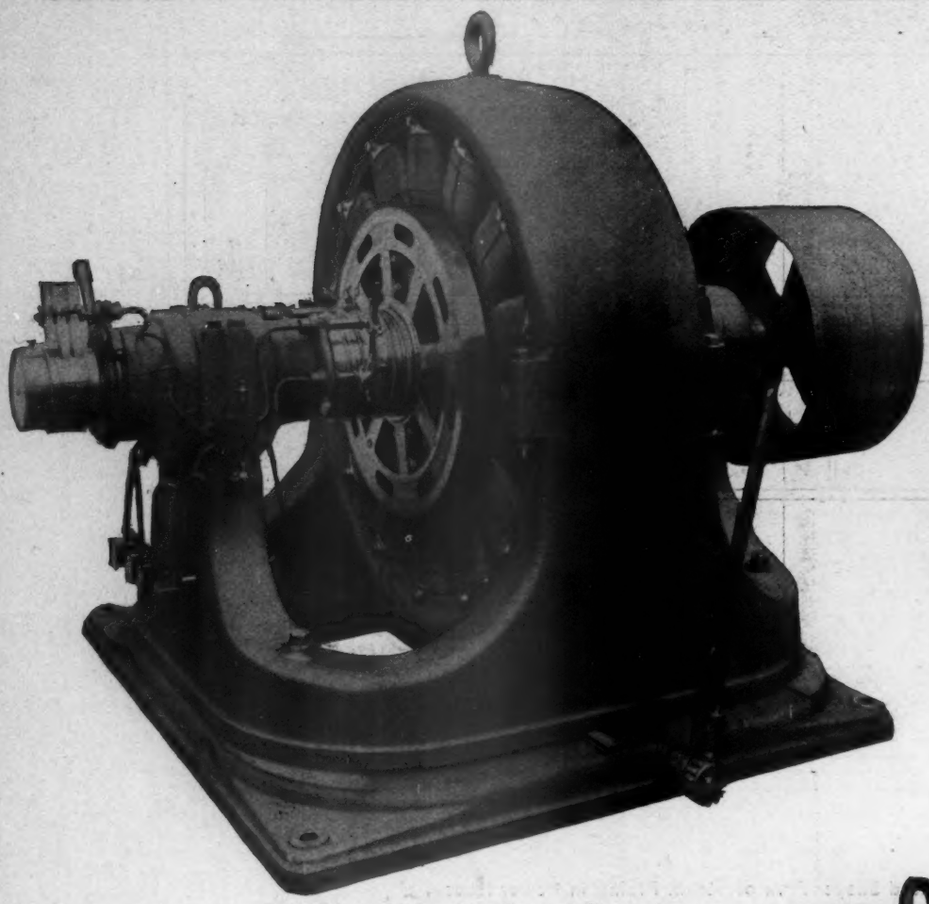
The alternating current crane motors are provided with a regulator, illustrated by one of the cuts, by which the pressure of the current is varied. The control of the motor is somewhat similar to the control of a variable speed engine by the throttle, which reduces the steam pressure delivered to the engine, thus enabling its speed to be varied at will over a wide range. The motor receives from the regulator a pressure varying from a small amount up to the maximum for which the motor is adapted. This variation gives a starting torque which has a maximum value equal to about four times the torque which the motor can develop at high speed continuously. The motor has a certain maximum speed which it does not exceed, even though the full pressure be applied and there be no load. This is of very considerable practical importance in assuring that no accident will occur through the abnormally high speed which might otherwise result if the load be suddenly thrown off. The regulator provides a wide range of adjustment by small steps, so that practically any torque at any speed can be obtained over a very wide range.

The regulator consists of a special form of transformer by which the voltage is efficiently reduced. A number of terminals are brought out from the transformers which are carried to the regulator, so that the pressure from the various contacts can be successively applied to the motor. The crane motors are exactly similar in construction, operation and simplicity to the constant speed motors. The difference between the constant speed and variable speed motors is in certain details of construction. Three or four wires are all that are required between the circuit and regulator and also between the regulator and the motor.

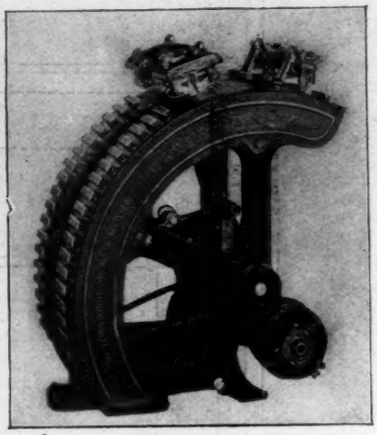
Steam Heating System.

The large shop buildings are all heated by the fan system, while the store house has ordinary steam radiators. The fan equipments were furnished by the Boston Blower Co., and are all alike, except as to the heaters, which vary in size in accordance with the sizes of the buildings. A description of one of them will, therefore, answer for all. It should be noted that there are two heaters in the locomotive shop, offering the advantage of closer regulation of the heating in moderate weather than would be possible to obtain with a single large heater.

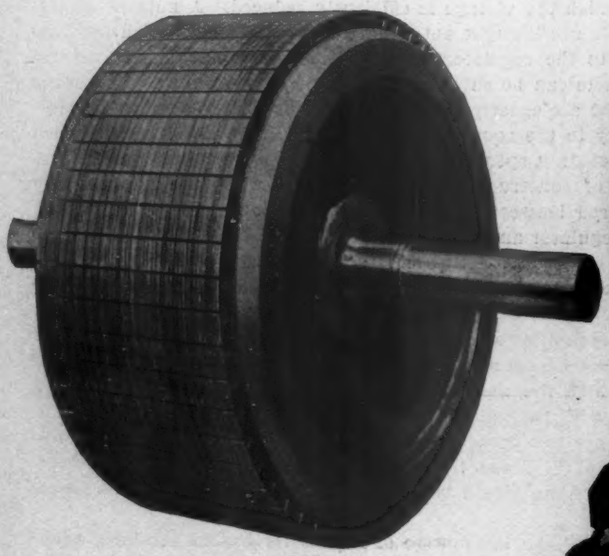
Each of the locomotive shop heaters has 22 sections, each having 80 eight-foot pipes and giving a radiating surface of 14,740 lineal feet of one-inch pipe. The blower is the Boston steel plate exhauster with full housing. The height of the fan is about 10 feet, the fan wheel is 72 inches in diameter by 34 inches wide at the periphery, and 42 inches wide over all. The inlet has a diameter of 50 inches, while the outlet is 44 by 40 inches. The housing is of heavy steel plate, braced with T and angle iron. The fan is directly connected to a seven by seven-inch engine, as usual in this system of heating. The steam manifolds are subdivided and piped so that either live



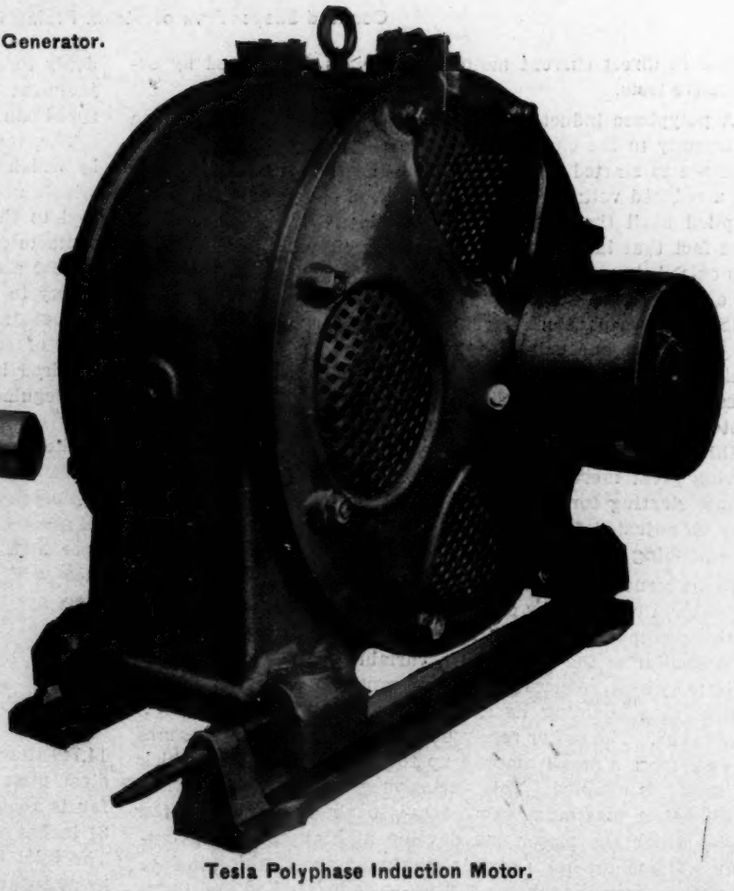
Belt-Driven Alternating Current Generator.



Regulator for Crane Motors.



Armature of Motor.



Tesla Polyphase Induction Motor.

CONCORD SHOPS—BOSTON & MAINE RAILROAD.

Electrical Machinery by THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY.

or exhaust steam may be used in the several sections of the heaters.

To reach the heaters in the different shops an extensive system of underground steam and return piping was necessary. This system is conducted through trenches of ample size, all of which are given pronounced slopes for drainage not only of the pipes, but of the trenches themselves. They are provided with concrete floors, brick side walls and plank covers. The heating pipes extend north from the power house a distance of 780 feet and south 890 feet. They carry a pressure of 30 pounds per square inch. All of the condensation, except that from the heaters themselves, is returned to the boiler house hot water tank. The steam piping was put in by Messrs. Isaac Coffin & Co., of Boston.

By returning to the plan of the piping in the power house and also to the large general plan of the shops and grounds (see our February issue), the arrangement of the steam piping will be understood. The north eight-inch main in the power house extends through the planing mill wall and supplies the planing mill heater and the dry house radiator coils. From the south eight-inch main a six-inch extension runs south through the planing mill and at the extreme south end of the mill it passes underground through a brick trench to the car repair shops, entering that building on the east side of the partition wall between the freight and passenger car shops. It serves the heaters in these shops and passes on to the paint shop, as indicated in the large plan. Each heater has a separate trap, the drainage being discharged into the sewers. Only one expansion joint was used in this line, it being necessary to put one in the long straight run in the planing mill. A two and a half-inch pipe reduced to a two-inch and one and a half-inch is run along under the large pipe for use in heating water and glue during warm weather.

The steam pipes running north connect with the north header in the boiler room and pass directly down and into the trench, which is marked "conduit" in the large plan view (see inset with February issue). This conduit is two feet four inches deep at the power house and is four feet nine inches deep at the locomotive shop, a good slope for a distance of 378 feet. A six-inch pipe runs through the north trench and it makes two turns in order to avoid expansion joints. The main changes from six inches to five inches at the blacksmith shop connection. Traps are located at the wall of the locomotive shop and also at the extreme end of the line at the heaters. For anchorages large stones were buried, each about four feet square and one foot thick, care being taken to provide side bracing along the pipe line to hold its alignment. The pitch of the pipes was a little greater than that called for in the specification, viz.: 1-16-inch in 12 inches. An expansion joint was found necessary in the long straight run in the locomotive shop. Nason steam traps are used throughout on the steam piping, except one trap for the 12-inch boiler heater. The traps, except one, are all arranged to discharge either into the sewer or the hot well system, as desired. The "Rainbow" packing was used throughout the plant for flange joints as being undoubtedly the best for the purpose.

Special care was taken in regard to protecting these long lines of pipe from condensation, "Magnesia Sectional Covering" being furnished for the entire steam piping system, both for power and heating purposes, requiring nearly 4,500 linear feet of pipe covering of varying diameters. Of this nearly 800 feet was for six-inch pipe. This was all furnished by Messrs. Keasbey & Mattison Co., of Ambler, Pa., and as a very large number of valves, Ts, crosses and other fittings were also covered, the order was a large one.

In closing this description it should be stated that the work was all carefully planned beforehand and every part of the installation was carried out according to the drawings. This included the piping, and it is stated that the plans were not changed at all during the progress of the work. Some comments would be in order here but for the lack of space.

We desire to acknowledge the courtesies of Mr. Henry Bartlett, superintendent of motive power, Mr. J. T. Chamberlain, master car builder, Mr. C. H. Wiggin, master mechanic at Concord, and Mr. G. E. Mitchell, chief draftsman of the motive power department, for information and other assistance in preparing these articles.

On page 76 of our March issue, in giving the names of concerns having furnished machinery for the Concord shops of the Boston & Maine Railroad, we inadvertently gave the address of the Putnam Machine Co. as Worcester, Mass., when it should have been Fitchburg, Mass. This firm is so well known that the error will hardly be noticed, but we regret that it was not stated correctly.

THE RAILWAY SIGNALING CLUB.

The March meeting of this club was called to order at the Duquesne Club, Pittsburg, March 8, Mr. W. H. Elliott, vice-president, in the chair, and 30 members present.

The paper of the day, entitled "The Operation and Maintenance of a Block System on a Single Track Railroad, as Used on the C., N. O. & T. P. R. R.," written by Mr. W. A. D. Short, was read and discussed. The principal points brought out in the paper and discussion were:

Questioning rule 4, which requires that "Trains of an inferior right approaching a meeting point within the limits of a block, may pass the red signal and proceed to the siding when under full control." By decision of the majority of the members, it was stated that signals should be re-located so that this rule would not be required, it being a bad plan to have trains run by a signal, under any circumstances, when at danger.

The point in regard to the rule requiring the engineer to observe the signal change to danger before he passed it was fully discussed. The sense of the meeting in this regard was, that with the automatic signals in use to-day, this was an unnecessary precaution and that full confidence should be placed in the proper working of the signals; that the disadvantages of requiring the engineer to stop balanced the protection to be afforded by his using caution in going through the block, so that it was very doubtful if there was not more danger in taking the indication as a danger signal in place of the clear signal.

The use of lead-covered copper signal circuit wires for burying in the ground was, from the experience of the members, thought to be very unsatisfactory, owing to the eating away of the lead from the chemical action of acids in cinders in certain soils.

A discussion in regard to insulated joints brought out a very favorable opinion of the members in regard to the excellent service to be obtained from the Weber joint.

The protection of electric street railway crossings of steam railroads was taken up and informally discussed. The general opinion seemed to be that a complete interlocking was necessary for efficient protection; that the device in use at Cleveland and some few other places, where the conductor was required to go ahead and by pulling a lever and close a derailing switch would allow the car to go over the crossing, was a very poor one, as there was no certainty that the conductor would use ordinary caution and assure himself that there was no train approaching; that although this might relieve the steam railroad of any responsibility should an accident occur, still the fact was that the accident would not be prevented, as would have been the case had a complete interlocking been put in.

In the evening a complimentary banquet tendered by Mr. E. H. Goodman of the Union Switch & Signal Company, was held at the Duquesne Club, and it was very enjoyable.

Arrangements were perfected by which the Pennsylvania Railroad would put a train at the disposal of the club on Wednesday, by which trips would be made to the Carnegie plant at Homestead, the Westinghouse Air Brake Works at Wilmerding, the Westinghouse Electric Works at East Pittsburg and the Union Switch & Signal Co.'s works at Swissvale.

It is reported, upon what appears to be satisfactory authority, that the Wagner cars will displace those of the Pullman Company on the Union Pacific, and undoubtedly the service will be greatly improved by the change.

THE CONSTRUCTION OF A MODERN LOCOMOTIVE.*

II.

By Motive Power.

The amount of material carried on hand at any one time should, as far as possible, be about equal to the amount of output for the same period of time, and in works managed in that way it will be necessary in connection with new orders to arrange for the arrival of material and its ordering in connection with the capacity of the department in which that material is to be used, and orders in the general office for material specified on the lists are made accordingly. All orders for work of whatsoever kind, with the one exception to which we will refer later should be issued from the general office, and

MODERN LOCOMOTIVE COMPANY.

Work Order.

Date..... .....189.. No.....

From Supt's Office / To ..... | Charge to Work Order No.....

To Furnish:

Drawing No.	Wanted.
Delivered to	For
Completed	Cost

Material Order Cards Issued:

When Completed, Card Must be Promptly Sent to Office of Supt

Fig. 4.

the detail of their issue and their manipulation be sufficiently simple to entail the minimum of expense and clerical labor, and a maximum amount of accuracy, as matters of record. For this purpose two distinct forms have been found sufficient and satisfactory, one known as the "work order" form and illustrated in Fig. 4, and the second one as a "material order" form and illustrated in Fig. 5. A third form, illustrated in Fig. 6, is also issued from the accounting department for the purpose of keeping record of the time or labor expended on any particular job.

For the purpose of giving a charge, as well as the authority to do certain work, a work order form is issued from the general office, having been filled out in the proper spaces indicating the number of the order to which the work is to be charged, giving a description of the work, the drawing number and such other information as would answer to intelligently guide the head of the department to which the order is sent in getting out the work specified.

number is also marked on the list corresponding to and having the same number placed on the order card referred to. This list in the hands of the head of the department to which the order was sent becomes a guide for that department as to the quantity and kind of material which they will require and can draw from the storehouse.

MODERN LOCOMOTIVE COMPANY.

Material order.

Date.....189.... No.....

From Supt's Office, / To ..... | Work order No.....

Required:

Drawing No.	Wanted.			Charge to	
Date.	No. of pieces.	Kind of material.	Weight or quality.	Price.	Received.

When completed, card must be promptly sent to Keeper of Stores.

Fig. 5.

At the same time the work order referred to is issued an additional form of the same kind is filled out and sent with it, but having a separate number for each department to which it may be sent, in contradistinction to the case of the other form, which has the same number for all departments in which any work may have been done. This second card is termed a "spoiled work order" and to it is charged all of the work which may be spoiled during the construction of that particular job. There being a different number on each one of these spoiled work orders for each shop, the amount of spoiled work on any one particular order is thus identified with the shop in which it has been spoiled.

In case there is a shortage of material required, owing to omission on the list or owing to spoiled work or smaller parts being lost or found defective, the material order card illustrated in Fig. 5 can be issued bearing the same work order number above referred to and specifying the kind and quantity of material required. This card can only be issued by the general office and after notification from the shops or storehouse of the shortage and the reason why. A record is kept in the

MODERN LOCOMOTIVE COMPANY.

No.....

.....Shop. Time Card. .....189..

No. of pieces.	Description of parts.	Contract card number.	Operation.	Work order.	Commenced.		Finished.		Hours.		Rate.		Money.	
					Date.	Time.	Date.	Time	Day-work.	Piece-work.				

Names of men in Gang.	Piece-work hours.	Rate.	Money.		Correct:
					Foreman.

Fig. 6.

For the ordinary run of regular output this card is accompanied by a complete list of the material required for that work, made out in and verified by the drawing room. Copies of this list are also sent to the keeper of stores, and it becomes for him a warrant from the general office for the delivery of the material for that particular order number. The order general office of the issue of the work order cards referred to, and also the issue of the extra material orders, and an entry is made in this record as well as on the face of the material order indicating the reason why extra material was required. At the completion of the order the lists which have been issued for the job, as well as the material orders for extra material or the replacement of defective or spoiled material, are returned

*For previous article see page 79.

to the general office by the keeper of stores and these must check with the original record of their entry.

It will be noted that on the work order cards a space is provided to indicate the shop or department to which that particular division of the work is to be sent. On the lists also are indicated in the proper columns the various shops or departments in which the various parts are constructed.

For convenience and brevity the various shops or departments may be indicated by initial numbers or symbols. It is also convenient to indicate the course of works by a succession of shop initials placed in the order in which the various stages of the work to be performed, on the card, for instance:—"S," "M" and "E" would indicate that the smith shop

MODERN LOCOMOTIVE COMPANY.

Annual Work Order Material Card.

From.....

To..... 189

Description of Material.	Wt. or Quantity.	Price per Unit.

Charged to Annual Work Order No..... .....

Foreman.

Fig. 7.

had performed the first operation on that particular piece, and it should be sent next to the machine shop for that operation, and follow from there to the erecting shop for the last operation. Various modifications of this will naturally suggest themselves, governed by peculiar conditions of the facilities of the plant.

There is no reason why the larger percentage of the work done in the shop should not be on a piece work, or practically a form of contract system, and for the purpose of keeping track of the amount of time and the separate jobs detailed to the men, the foreman is provided with a contract card, which he issues to the man or men who are going to perform the work, and which bears on its face a designation of the particular job, the contract price and other necessary information. A record of this card is kept in the foreman's office, and each card is given a number. These numbers are entered by the men on their time or service cards (illustrated in Fig. 6) under the proper heading. Where wages are paid by the month these cards should be recalled to the foreman's office on or about the end of the month and the man given credit for that proportion of the job which he may have finished up to that time, in case the job is not completed. This proportion is arrived at by the judgment of the foreman, and it will be obvious that, as very few jobs take more than a month, or, at the very outside, two months, the man will receive the balance in the next succeeding pay. A form of this card is illustrated in Fig. 10.

A clear and concise knowledge of the expenditures for repairs to tools and machinery, buildings and the various other facilities may be so arranged that the total of these expenses, forming as they do a portion of the expense charges, can be determined for each separate department at the end of each month, if desired, and becomes one of the essentials of proper and economical management. For the purpose of determining this as many divisions of this kind of expense may be made as are deemed advisable or would properly suit the peculiarities of the plant, and for the purpose of saving unnecessary clerical labor this may be governed by the issue of a work order card for each of these divisions, bearing a separate number for each and a separate number for each shop, specifying what it is desired to include under that particular order number. For instance:—The repairs and extensions made to any one particular shop building during that year or the repairs and extensions made to the tools and equipment included in that one building during the year may be so handled. All work performed and material used may be charged to this number and arrangements made for condensed monthly reports of the returns of such expense made to the accounting department.

It has been found convenient as a system of management to consider each department as a separate and distinct enterprise of its kind, against which are charged the expense for wages, material consumed in repairs of building, tools, etc., cost of ordinary shop supplies, material consumed in manufactured output by that particular department, and also a proportion of the fixed charges for superintendence, office expenses, etc., crediting that department with the value of its output; and in most cases, following it in this way, it will be found that all of the elements necessary for detecting defective management, unnecessary extravagance, and for increasing the economical efficiency of this department, can be determined.

There is no reason that we know of why each department should not be made to pay its own expenses, and frequently it becomes purely and simply a question of improved facilities to be used in preference to the facilities then in service.

For reasons which have been found exceedingly satisfactory in connection with repairs and additions to tools and machinery, or to buildings or the various other equipment of the plant, the judgment of the foreman of each department governs the amount of repairs made to the equipment in his department, including its building or buildings, and for the purpose of getting the necessary material, which is usually carried in stock for that purpose, he issues from and keeps record in his office a special form of material order, shown in Fig. 7. This form should specify the kind and amount of material required and the yearly work order number for which that material is to be used. They are kept by the keeper of stores, the price of that material put on them, and sent by him to the accounting department.

As will be more thoroughly explained below, these cards are also issued for drawing the regular run of shop supplies,

MODERN LOCOMOTIVE COMPANY.

Record of stock received and consumed.

Location.		Description.	Order number.	Date.	Quantity.	Furnished by	Quantity rec'd.	When received.	How received	Price per unit.	Cost of freight.	Total cost.	Bill number.	Month charged.	Freight weight.	F. O. B.	January.			February.			March.		
Sec.	Bin.																Total rec'd.	Quantity consumed.	Quantity on hand.	Total rec'd	Quantity consumed.	Quantity on hand.	Total rec'd	Quantity consumed.	Quantity on hand.

Fig. 8.—(About 45 lines).

small tools, etc., which are constantly required and are kept in stock in the storehouse. It has in some cases been found convenient to include this line of supplies under the general heading of "Repairs and additions to tools and machinery."

We desire to impress on the mind of the reader more particularly the flexibility of this scheme than its being confined to any particular division, and that various and possibly more convenient divisions of these yearly orders covering the expenditure which would be included in expenses may be made to suit peculiar cases. The time expended in using material for the yearly work order in that particular department is entered on the time form shown in Fig. 6, using the yearly work order number for its identification.

The confidence in the foreman indicated in this has been sufficient protection against extravagance or the unnecessary expenditure of money in repairs to equipment and buildings, and a comparison of the monthly reports giving these expenses affords a check against any unnecessary and excessive increase.

As already indicated, the various employees working by the hour throughout the plant enter up their own time on the form shown in Fig. 6, and each one of these forms must be carefully scrutinized by the foreman of that department in which the men are employed and be signed by him, after which they are returned to the accounting department, from which department they have been originally issued. These forms are issued in sufficient numbers daily for the requirements of the plant, and each one of them having a number corresponding to the assigned number of the employee who is to use that particular card.

All of the stock of material kept in the storehouse may be divided into departments for convenience of location and handling, and where bins or convenient shelving are provided the amount of stock placed in these bins or removed from them, from time to time, may be entered on a card prepared for the purpose and kept in a convenient pocket in the bin. The entries on these cards should only be made by one man in the storehouse to insure greater accuracy, and this constitutes a daily record of the consumption of that kind of material. At the end of each month the amount consumed, as indicated by these cards, may be entered in the receiving and stock book.

The care, handling and record of raw material received or distributed, in this case by the storehouse, is one of the most important questions connected with proper management of the plant. The records should be clear, concise, free of unnecessary repetition and complete in detail, and a daily record of material received and monthly record of material consumed, showing proper balances, etc., should be kept on one set of blanks, either bound in book form or kept on cards. For reasons which will be explained, we consider the card system to have great advantage over the book form. If bound in the book form there should be enough pages to cover a period of three months, which will make the book less bulky, and provide for a quarterly stock-taking or check on the condition of stock of raw material on hand. One of the pages of this form of stock-book is illustrated in Fig. 8. It will be obvious that this form has one principal objection, that the various items will have to be kept in alphabetical order, and, owing to its bound form, spaces must be left anticipating additional shipments of the same kind of material during the three-month period that the book remains open. This is more or less uncertain, and it provides for an excessive amount of waste space, and for other reasons has its objections. It is true, however, that the combination of what would practically be a receiving book with a stock-book has an advantage which two separate books would not have. Its bulk, however, and the practical impossibility of grouping together similar kinds of material for the purpose of condensed information, would make its adoption in some cases impracticable.

Fig. 9 illustrates a form of card used in what we will term the "card system" of keeping stock record, and this avoids the objections raised against the book form. The rulings, divisions and headings are practically the same as that illustrated in Fig. 8, except that enough lines can be provided on one of these cards to cover a period of six months or a year, or less, if desired. In the use of these cards it is intended that each item of stock shall have its own classification, and be indicated by a number. This number will be placed on the upper right hand corner of the card, and as many cards may have this number as would be necessary to provide proper room for entries of that one kind of material. This will make it unnecessary to have the cards any larger than would be convenient for handling. The section letter of the storehouse and the bin number in which the material is stored are entered in the upper left hand corner, and the intervening space filled in

MODERN LOCOMOTIVE COMPANY.

Stock Record.

Section.....
Bin No..... Class No .....

Date.	Order No.	Quantity.	Furnished by.	Quantity rec'd.	When rec'd.	How rec'd.	Price per unit.	Freight.	Total cost.	Bill No.	Month charged.	Freight weight.	F. O. B.	Total rec'd.	Total consumed.	Total on hand.

Fig. 9.—(About 12 lines.)

MODERN LOCOMOTIVE COMPANY.

Contract Order Card.

From .....
To..... .....189..

Enter on each card items chargeable to one account only.

Charge to work order..... .....Completed .....189..

Fig. 10.

MODERN LOCOMOTIVE COMPANY.

Credit Work Order No ...

From.....
To..... .....189..

Description of Material.	Wt. or Quantity.		Price per Unit.	

Wt. or Quantity and Price per Unit to be Added by Keeper of Stores. .....

Foreman.

Fig. 11.

with a description of that particular kind of stock. At the end of each month the total of that stock received is entered under the proper column, also the total of the stock consumed and the total on hand, and the transaction for that month practically closed on the card, the date of receipt of the material indicating the portions of the month or termination of the month or the beginning of the next succeeding month. Any special forms of calculation in connection with the stock or material entered on the face of these cards, or memorandums relating to it can very properly be made on the back of the card, where they remain as an individual record. These cards may be kept in a case divided up into as many compartments as would be required, and kinds or groupings of material kept by themselves. They are more available for quick consultation than the book form, and have an advantage over the book form in that similar kinds of material may be grouped to any desirable extent. This method of keeping stock has many other advantages which will be apparent to the reader, without going into further details.

It will be obvious that the column headed "Month Charged," while not necessary for use in all cases, will be required in certain special cases which would have a more or less direct bearing on the carrying out of the system of costs and expenses in the accounting department, and in this connection we consider that, as far as the general question of raw material is concerned, the most important questions connected with it are, to buy well, use well and quickly transform it into the finished product at the minimum cost. With a reliable system in the storehouse of receiving, caring for and dealing out of the raw material, an ordinary form of merchandise account in the accounting department should be ample in connection with this phase of the question.

Without going into the detail of what the various subdivisions would include, the general headings "Total Expense for Raw Material," "Total Expenses of Operation," which would include all wages, interest and other details properly included under "Expenses," "Total Value of Output" and "Excess" or "Stock Shortage" at the end of the year are the vital figures to be arrived at.

We have referred to a system of credits for excess material which may have been specified on the lists, owing to the fact that the exact amount could not be determined. A special form provided for this purpose, printed in red ink, is illustrated in Fig. 11, and is to be used at the completion of an order by the various departments in which work has been done on that order. It will have inserted on it the amount and kind of material in excess of that specified on the lists as necessary and also the work order number on which the balance of that material was used, indicating at the same time the work order which should have credit for that excess of material. These cards are sent to the general office and the proper credits or corrections made on the original lists. They are then sent to the keeper of stores, who will make the necessary credits in his stock of that kind of material, put the prices of that material on these cards, and they will then go to the accounting department. It should not be necessary to repeat this operation on succeeding orders for a similar class of engine, for the reason that a proper return of these credits once will definitely decide the amount of material to be used on the succeeding orders of engines.

Independent of the material which we have referred to above as being ordered for a certain order of engines, there is a large amount of material which is consumed by the shops themselves in connection with their maintenance and operation, coming under the heading of small tools, belting, and a variety of such supplies, and these may be drawn directly from the storehouse on a form of material card issued by the foreman of the department where the material is required and are charged directly to that department and order number. It is convenient to arrange, and have it so understood with the various departments, that the supplies which they require shall be drawn at or about the same period each month, and at that time they shall endeavor, as far as possible, to draw enough supplies to cover one month's necessities. This will periodically reduce very greatly the stock on hand of this kind of material and make it less troublesome to check up at the end of each month not only the stock remaining on hand, but to arrive at the amount of material required for the next ensuing month, it being considered good policy to only purchase this class of material in quantities equal to about its consumption per month.

(To be continued.)

CONTRIBUTIONS TO PRACTICAL RAILROAD INFORMATION.

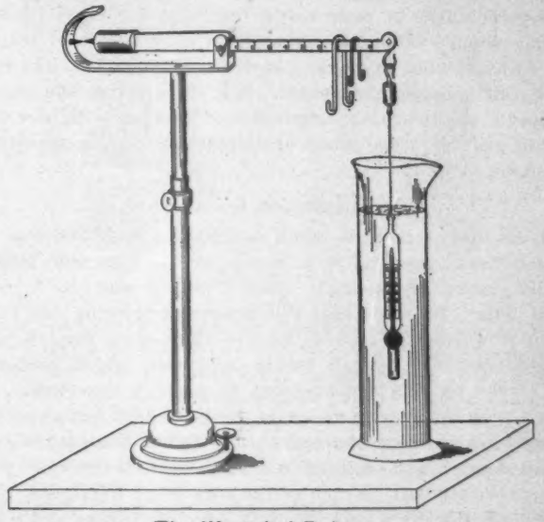
Chemistry Applied to Railroads.—Second Series.—Chemical Methods.

XXIII.—Method of Testing Spirits of Turpentine.

By C. B. Dudley, Chemist, and F. N. Pease, Assistant Chemist, of the Pennsylvania Railroad.

Explanatory.

As is well known, spirits of turpentine, so largely used as a constituent of paints, japans, and varnishes, is a distillate from certain species of pine, or from the pitch from these pines. The common adulteration in the markets of this country appears to be petroleum in some form, although it is quite possible that rosin spirits, or the undistilled pitch, or even rosin, may be added. It is not expected that the tests that are described below will insure that nothing but pure spirits of turpentine is present in the sample examined, or in other words, that none of the sophistications above mentioned, or indeed others not enumerated, may not be present in small amount. It is believed, however, that a material that successfully passes these tests will give satisfactory results in actual use, either as a constituent of paint, japan or varnish. During an experience of over five years with these tests, using them on from



The Westphal Balance.

ten to fifteen shipments a month, very few complaints have arisen, notwithstanding the shipments are used by a large number of different painters. The tests which are applied to each sample representing a shipment, are gravity, distillation point, residue on evaporation and treatment with oil of vitriol. The methods are described in detail below.

Gravity.

The specifications require that the sample shall not show a gravity less than 0.862 at a temperature of 59 degrees Fahrenheit. In taking the gravity of this material, the Westphal balance is always used, as follows: Set up the balance on a level place, by placing the beam in position and hanging the plummet on the hook provided for it. Now adjust with the adjusting screw in the foot until the pointers are exactly opposite each other, cool the liquid to be tested to a point a little lower than that required by the specification, fill the jar with enough of the liquid, to a little more than cover the plummet, and place the jar in position. Allow the temperature of the liquid to rise with occasional stirring, until the reading of the thermometer in the plummet is that required by the specifications. Now hang the weights on the beam at the notches provided for them, until the pointers are again exactly opposite each other. If two belong on the same notch, hang the second on the hook of the first. Read the marks on the beam

where the weights hang, and set down the figures by the side of each other, putting the figure under the heaviest weight at the left hand, that under the next heaviest, next, and so on. The result will be the specific gravity expressed in decimals.

The Westphal balance shown in the cut is usually now constructed with a plummet weighing five grams and occupying the space of five cubic centimeters. This is called Reimann's Patent Thermometer Body. The beam is graduated into equal divisions, and the heaviest weight weighs five grams. The next size weight weighs a tenth of this, the next a hundredth and the smallest a thousandth. The balance being adjusted in air, so that the pointers are exactly opposite, if the plummet is immersed in distilled water at 15 degrees C., the heaviest weight being placed on the hook with the plummet should bring the pointers opposite each other again.

Rosin, pitch and probably rosin spirits, if present, would increase the gravity, while the colorless petroleum products available for admixture would diminish it. Absolutely pure, properly prepared spirits of turpentine, is claimed to have a gravity of 0.864. In order to allow a slight margin on this figure, the limit of the specifications was placed at 0.862, no upper limit being assigned, as the other tests applied, are believed to exclude material too heavy in gravity. Furthermore, the gravity of pure spirits of turpentine increases with the age of the sample, so that an upper limit of gravity, made close enough to exclude small percentages of rosin spirit, for example, might be troublesome when examining a sample of pure spirits of turpentine, which, owing to the exigencies of the market, had been stored a little longer than usual. It is obvious that the gravity test only protects against admixture of substances lighter than 0.862 in gravity. The mass of shipments show a gravity of from 0.866 to 0.872.

Distillation Point.

The distillation point is taken in a 500 c.c. round-bottom distillation flask, provided with a side neck. This side neck is usually made of ¼ inch glass tubing, and is 7 or 8 inches long. In order that the danger of igniting the vapor driven off during the process may be diminished, the side neck is introduced into a small Liebig condenser, which condenser also serves by this arrangement to support the flask. The condenser is set at such an angle that the flask hangs perpendicularly. A chemical thermometer, with the graduation on an enameled scale, and enclosed in a glass tube, is inserted in the flask, to within half an inch of the surface of the liquid, being held in position by a cork through which it passes and which closes the flask at the top. The apparatus being arranged, about 100 c.c. of the spirits of turpentine are poured into the flask, and the thermometer put in place. Then, with a Bunsen burner held in the hand, with the flame about four inches long, heat is applied directly to the bottom of the flask, care being taken to distribute the heat by playing the flame, so that the whole bottom is heated slowly and evenly. Vapor soon begins to rise from the surface, which is visible. Also the thermometer begins to show the heat. The heating should be so managed that by the time the liquid boils, the visible vapor surrounds the thermometer up to the side opening, or begins to pass out through the side opening. To accomplish this it may be necessary to withdraw the lamp from time to time to allow the heat to distribute, and the thermometer to adapt itself to the temperature. By the time the boiling point is reached the thermometer, if the sample is pure spirits of turpentine, should show not lower than 305 degrees Fahrenheit. The boiling may be continued from five to ten seconds, during which time, if the heating has been properly managed, the thermometer will stand fairly constant. As the boiling is continued the thermometer slowly rises in temperature. The fairly constant reading during the first few seconds of boiling is what is taken as representing the distillation point of the sample. It is given in the authorities that pure spirits of turpentine boils at 313 degrees Fahrenheit. Some years ago a number of samples of American turpentine, believed to be pure, were tested in the manner described above, and some of them found to give figures a little lower than this. Accordingly, the lower limit of acceptable material was placed at 305 degrees Fahrenheit. The mass of our tests run about 307 or 308 degrees Fahrenheit, the average barometric pressure being about 29 inches of mercury.

Obviously, this test simply excludes any admixture of materials of low boiling point, such as low boiling point petroleum, or low boiling point volatile oils.

It may seem a little hazardous to apply the naked flame to a glass flask containing so inflammable a substance as spirits of turpentine. But after an experience of several years, the first accident from breaking a flask from this cause has yet to be recorded. The spirits of turpentine seems to take the heat readily, and the whole operation is free from bumping, unless perchance water be present in drops. Care should, therefore, be taken in putting the sample into the flask, that no drops of water are added. In selecting a thermometer, one should be chosen which is so graduated that the limiting figures will be only just above the cork, or, better still, just below the cork inside the flask. It will, of course, be recognized that unless the whole column of mercury is immersed in the hot vapor, the indications of the thermometer will be a trifle low.

Residue on Evaporation.

Spirits of turpentine, as is well known, is volatile at temperatures much below its boiling point, while rosin, pitch and indeed some of the petroleum products which may be used as admixtures do not so vaporize. The residue left on evaporation is therefore a valuable test for this material. The specifications do not admit material containing over 2 per cent. of residue. The test is made as follows: Weigh a platinum capsule holding out 100 c. c. and then add 20 grams of the sample to be tested, excluding drops of water, should any be present. Evaporate to constant weight over a water bath, or other convenient source of heat, not exceeding in temperature 250 degrees Fahrenheit. The increase in weight of the dish multiplied by 100 and the product divided by 20 gives the percentage of the residue. The material left in the dish is usually hard and brittle like rosin, and commonly reddish in color. Occasionally it is viscous, somewhat like pitch.

It is entirely possible that some of the residue found did not originally exist in the spirits of turpentine, but may have been formed during the process of evaporation. This point has not been carefully investigated to our knowledge. Whatever the case, there is very little difficulty in obtaining in the market spirits of turpentine which meets the requirements of the specification in this respect. By far the largest number of shipments do not show over 1 per cent. of residue. Very old material, however. is apt to run high in residue, and it not infrequently happens that an adulterated sample shows four or 5 per cent.

The temperature employed if the sample is pure seems to make very little difference in the result. Comparative tests on pure samples using water bath and a steam table whose temperature is 280 degrees Fahrenheit give practically the same results. The wording of the specifications requires the evaporation to be done at 212 degrees Fahrenheit, and in case of dispute this should always be used.

Treatment with Oil of Vitriol.

By far the largest part of pure spirits of turpentine polymerizes when treated with concentrated oil of vitriol, the polymerized portion dissolving in the acid. The same thing is true in part of rosin spirit and of some other substances which may be mixed with turpentine, but it is not true of the petroleum products, nor to any great extent of rosin oil. This gives a means, therefore, of determining the presence of some substances which may be present, and which are not revealed by the other tests. The specification excludes samples containing more than six per cent. of unpolymerized material. The

method of applying this test is as follows: Into a 30 cubic centimeter tube, graduated to tenths, put six cubic centimeters of the spirits of turpentine to be examined. Hold the tube under the spigot, and then slowly fill it nearly to the top of the graduation with concentrated oil of vitriol. Allow the whole mass to become cool and then cork the tube, and mix by causing the material to flow from one end of the tube to the other five or six times, cooling with water during the operation, if necessary. Set the tube vertical, and allow it to stand at the ordinary temperature of the room, not less than half an hour. The unpolymerized material rises to the top, and the amount may be easily read off. This multiplied by 100, and divided by six, the original amount taken, gives the percentage.

The oil of vitriol used must be full strength, or the polymerization will not be complete. It is best to use the C. P. material. The amount of heat generated by the action of the oil of vitriol on the spirits of turpentine is considerable. Usually much of the reaction has taken place by the time the acid is all added, but care should be taken to cool as described before putting in the cork and mixing. Otherwise the cork may be blown out, and the test lost. There is always some clear layer of unpolymerized material in every sample even the purest. This with a pure material is probably principally cymene. Most samples do not show over 3 per cent. of clear layer. If petroleum is present, the layer is limpid and clear. If partially polymerized turpentine is present, the layer is more viscous and frequently colored.

If the reading of the layer is taken before half an hour has elapsed, the unpolymerized material often has not all separated. On the other hand, if the time of standing is prolonged considerably, the material is apt to divide into three layers, making the reading difficult and uncertain. With pure material and reading at the end of half an hour there is very little doubt.

RECENT IMPROVEMENTS IN MAKING STAYBOLTS.

Test holes for giving warning of partially broken stay bolts have been used for a number of years. No one now doubts the necessity of providing in this way against the danger of partially broken bolts, and the present tendency is toward using test holes in all short stays, instead of in a few only, as was formerly considered sufficient. The holes were formerly always drilled with the bolts in place and headed over, but it is now necessary to reduce the cost, since more are used, which has led to the punching of the holes when the bolts are made. We show how this is done, and also the effects upon the bolts.

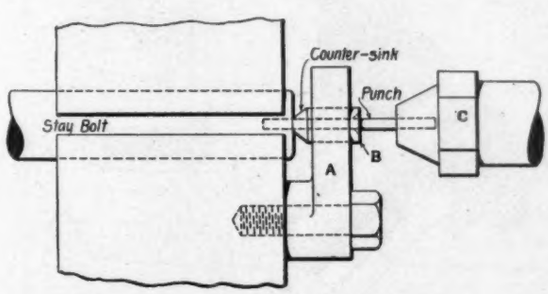


Fig. 1.

Another improvement in stay bolts is in the threading, and we show the method devised and developed by Mr. James Hartness for cutting the threads accurately in a turret lathe by means of dies.

Punching Test Holes.

A method used on the Chicago, Burlington & Quincy Railroad is shown in Fig. 1, the punching being done on a Blakeslee bolt header. The hot stay bolt is held in the clamps of the machine. A piece, A, is bolted to one of the clamps and is bored out to receive the cylindrical piece, B, which is a neat fit in the piece A, and yet sufficiently loose to slide in and out when pressure is brought to bear on it. The piece B is bored to allow the punch to pass through it and it is slightly bell-mouthed at its outer end to aid the punch in entering. This furnishes a guide to keep the alignment of the punch. The inner end of the piece B is tapered as shown, and it is so placed in relation to the plunger C as to cause the plunger to come into contact with it when the plunger still lacks about one-eighth of an inch from the end of its stroke. The plunger then forces the tapered end of the piece B into the end of the staybolt, counter-sinking the hole made by the punch. The object of this is to prevent the hole from being filled up when the staybolt is riveted over. The scheme will be readily understood from the engraving.

The etchings shown in Figs. 4 and 5 were kindly furnished by Mr. Wm. Forsyth, Mechanical Engineer of the C., B. & Q. R. R., and they were taken to ascertain the effect of the punching and the turning down of staybolts upon the fiber of the material.

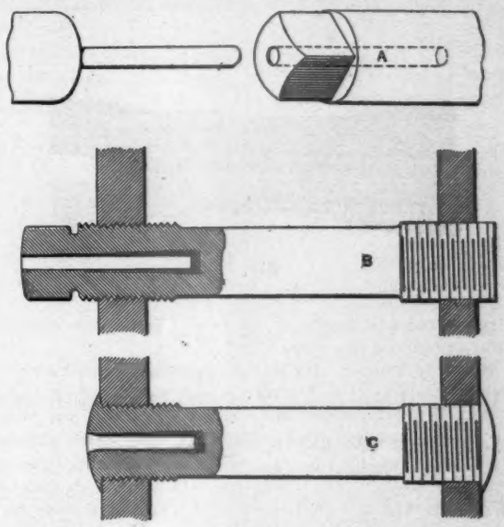


Fig. 2.

The bolts were screwed into the sheets of the fire box in the usual way and were headed over by the boiler maker's hammer. They were then sawed off just inside the sheets and were planed and etched. From an examination of the etchings it appears that there is little or no distortion of the fibres when staybolts turned down to a diameter of 11-16 inch at the center, and also that the hot punching of a ⅛-inch hole to the usual depth does not injure or distort the fiber.

The Baldwin Locomotive Works are punching all of their stay bolts on a bolt machine. It has been suggested that such a process improves the quality of the metal at the end by solidifying it, but the Baldwin people make no such claim, although they have satisfied themselves by severe tests that bolts so treated are fully equal to those drilled after the usual method. Their process as shown in Fig. 2 has been patented by Messrs.

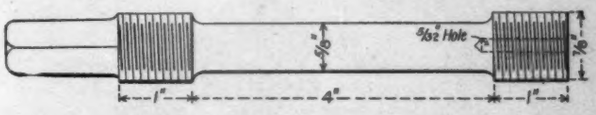


Fig. 3.

Johnson and Lukens. In this illustration A, is a perspective view of a stay bolt showing the punch. A view partly in section is shown at B, with the bolt after it is placed in position in the boiler and before it is cut off and riveted. A bolt is shown at C, after it is finished in the boiler. The square end of the bolt is made in order to turn it readily in screwing it into the sheets of the fire box. The bolt is held by the clamps of the machine and the punch enters the end after the square end is formed and when the bolt is removed from the machine it is ready to be threaded and turned down between the threads in accordance with the practice of these builders. After the bolt is in position in the boiler the square head is cut off and the ends riveted over, after which a tapered mandrel is introduced into the hole to flare the outer end as shown at C. No metal is removed by this process, hence the bolts are not weakened, the metal is merely

displaced by the punch and the end must necessarily be denser than before.

A plan similar to these was used by Mr. William Buchanan, Superintendent of Motive Power of the New York Central, but we are informed that the practice has been discontinued in favor of drilling. For the punching he used a punch driven by a cam on a shaft. The bolt was held by jaws operated by a hand lever and opened automatically by a spring, an adjusting

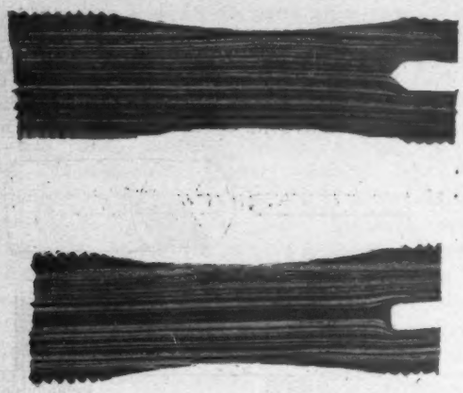


Fig. 4.

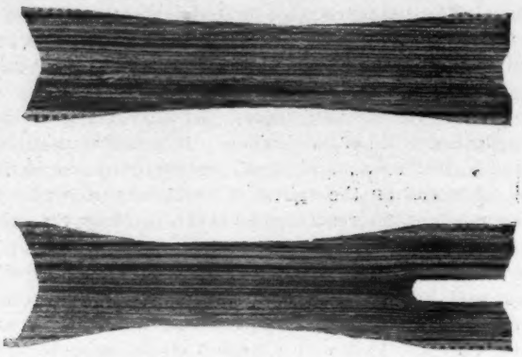


Fig. 5.

screw regulated the depth of the hole. With this machine 1,250 bolts were punched per day.

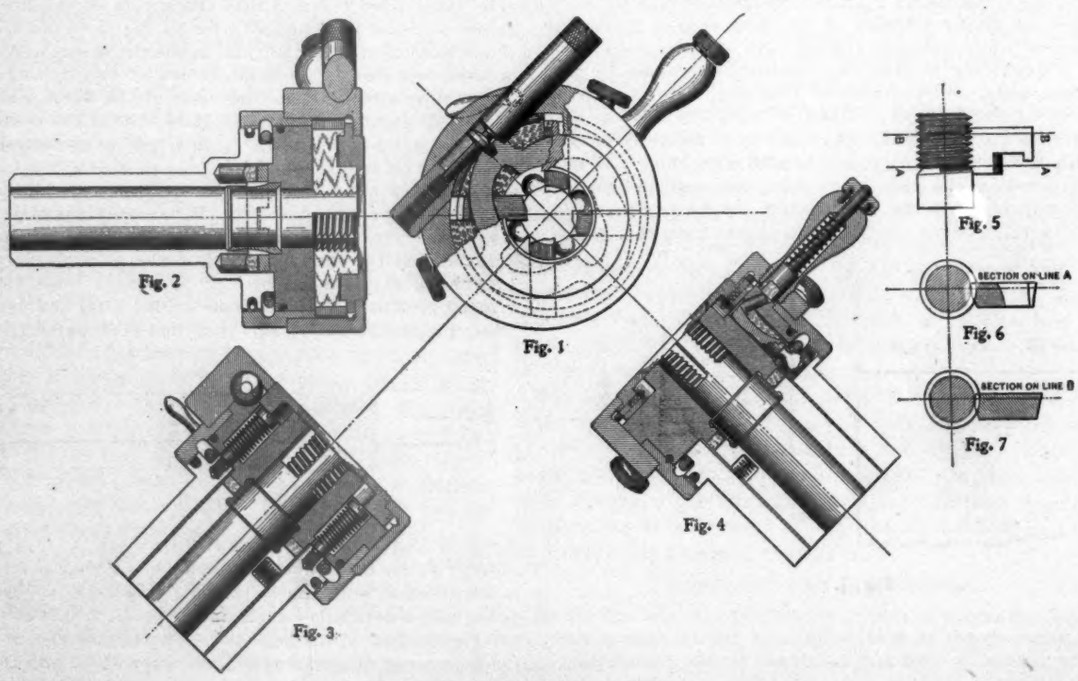
Mr. Wm. A. Foster, Superintendent of Machinery of the Fall Brook Railway, has found it desirable to reduce the diameter of stay bolts between their threaded ends, but instead of turning them down he draws them out under the hammer and considers the results much superior to those from similar bolts turned down. The form used is shown in Fig. 3. The threaded ends are one inch long and a six-inch bolt would be drawn down through a portion four inches long at its center, the diameter being ⅝-inch. The test hole is drilled 5-32 or ⅛-inch in diameter and a little more than an inch in depth. The threads are cut on a bolt cutter arranged so as to cut the threads correctly.

Improvements in Threading.

It is of the first importance that the threads at the ends of stay bolts should be accurate, and that they should form parts of a continuous uniform spiral. The holes in the sheets should be tapped with equal accuracy in order that the bolts may fit properly and be free from initial stresses that may be large enough to cause breakage in a short time. The diameter must be correct and the taps and threading dies should exactly correspond. It is due to Mr. James Hartness, Manager of the Jones & Lamson Machine Company of Springfield, Vt., that all this has been worked out and so simplified as to make it possible to turn and thread stay bolts on a turret lathe. The method was described by Mr. Hartness in two papers presented at the last meeting of the American Society of Mechanical Engineers in New York.

The bolts are turned from a bar. Tandem dies are used; they are held in position to turn continuous threads and they are made to open so that the front end of the bolt may pass through the first die without being cut. The tap may be used to fix the two dies in correct position, but Mr. Hartness' idea is to make the bolts correctly and the taps can be made to suit. It is clear that if the two dies can be made to cut parts of a continuous, accurate pitch thread, that shall have the same and the correct diameter the problem is solved.

The system of chasers used by Mr. Hartness is an improvement in screw cutting that is worthy of note. It is illustrated in the accompanying engraving. The chasers are held by a cam



The Hartness System of Dies.

encircling them, and preventing them from canting when at work. The fundamental point in the system is the determination of the pitch and angle of the chaser teeth. The difference in the position of the cutting and the leading teeth is shown in Figs. 6 and 7. The real difference is slight, being exaggerated in the drawing in order to be clearly seen. The cutting is all done by the leading teeth, the following teeth only guide the chasers and help to determine the pitch of the thread accu-

rately. The cutting teeth have an ideal cutting clearance on each side of each tooth, and these teeth are relieved of the labor of feeding the die forward. So accurate is the lead-controlling feature that regular dies for market seldom have an error in lead greater than one sixty-fourth in eighteen inches, which is less than one-quarter the average error in standard taps, and less than one-half the error in 90 per cent. of the engine lathes. Thus it is more accurate than the average lead screw and always practically sure, being made by methods insuring invarable accuracy of product and most perfect interchangeability.

Dies made in the usual way have three errors—that due to the lead screw in which the tap or hob is made, the distortion of hardening the tap or hob, and the error of the distortion of the die in hardening it—but Mr. Hartness has only one of these to contend with, viz., the distortion of the chasers in hardening, and this takes place under such favorable conditions as to be inappreciable.

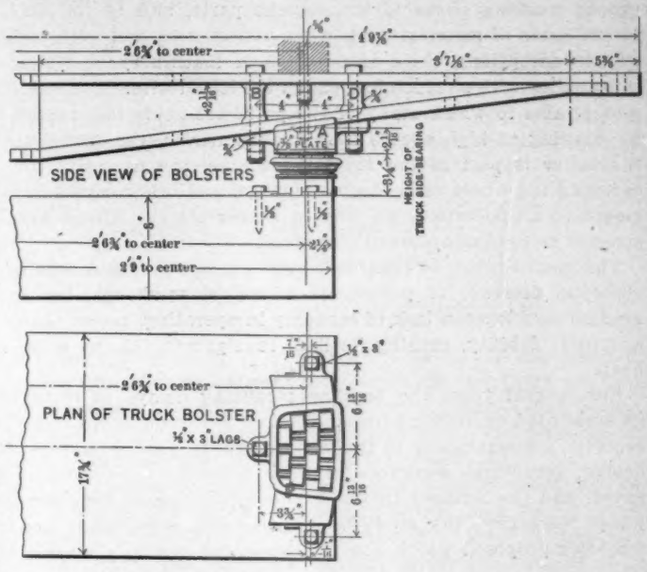
By the efforts of Mr. Hartness the manufacture of stay bolts may be given a refinement not before known, and an improvement in the stay bolt problem must follow his excellent work.

WHEEL WEAR AS AFFECTED BY SIDE BEARINGS.

About a year ago the Lake Shore & Michigan Southern built five express cars. One truck of each of three of them was equipped with the "Frictionless Side Bearing" made by the Chicago Railway Equipment Company, and the other trucks of these cars as well as both trucks of the other two cars were fitted with plain side bearings. Plaster of Paris casts were taken of the contour of the tires on all the wheels before they were put into service and after they had been in service a number of months casts were again taken to show the wear of the treads and flanges during that time. The results are shown in the accompanying engravings, reproduced from outlines furnished by the manufacturers of the bearings. All of the wheels were 36 inches in diameter and steel tired.

In these outlines, those numbered 1 to 4, inclusive, are from the trucks equipped with plain side bearings, and those numbered 5 to 8, inclusive, are from those equipped with the "Automatic Frictionless Side Bearings," the width of the shaded portions showing the amount of wear of each wheel. Car No. 590 runs on the Lake Shore & Michigan Southern express between Chicago and New York via the Lehigh Valley and Delaware, Lackawanna & Western roads, and when the casts were taken, December 1, 1897, the car had made 72,605 miles. The other car, No. 591, made 61,940 miles during the time of the tests, while running over the same route. Two of the cars fitted with plain bearings, the diagrams from which are not reproduced, showed greater wear than either of the others with mileages of only 57,113 and 53,112 respectively. The contour diagrams were taken by Mr. A. M. Waitt, General Master Car Builder of the road, who writes us as follows:

"A singular thing in connection with this is, that on the trucks having the special side bearings there is no perceptible flange wear on the wheels, while on the truck on the same car having common side bearings there is quite a perceptible flange wear. On both of the trucks having plain side bearings all around, there is a decided flange wear. The cars having plain side bearings ran 52,000 and 57,000 miles respectively, while those having the special side bearings have run as high as

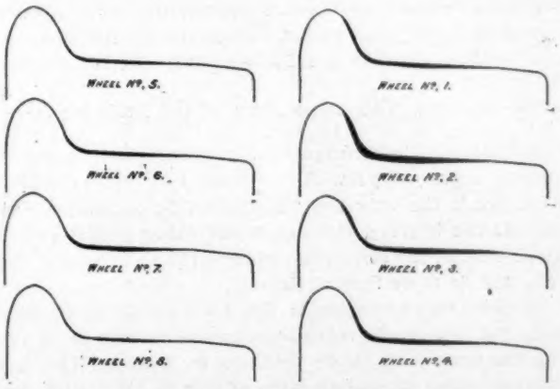


Side Bearing Fitted to Lake Shore Baggage Cars.

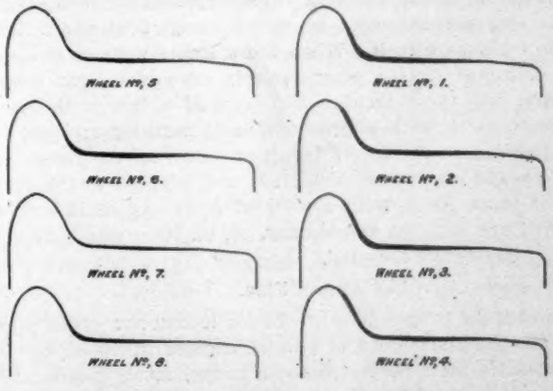
72,000 miles. The results convince me that there is a strong call for some device on passenger equipment to relieve the large amount of wear on wheel flanges occurring when passing around curves. The device I have tried has proven its efficiency and I am now applying more of them."

The matter of flange wear is very important not only as regards the expense of turning ties frequently, but also on account of the resistance of trains on curves when trucks are so bound by the side bearings that they do not curve easily. Tires often require turning on account of flange wear before the work becomes necessary from the wear of the treads.

In our engravings we include one showing the form of the roller bearings used on these cars and the method of attachment to the bolsters. We are informed that these side bearings have been applied upon some fifty railroads and that they are reported as giving excellent service.



Diagrams from Baggage Car No. 590.



Diagrams from Baggage Car No. 591.

A 900-foot dry dock has been decided upon by the Newport News Shipbuilding and Dry Dock Company, of Newport News, Va. It is to be commenced at once and will cost about $1,000,000. Its width is to be 90 feet and it will accommodate two of our largest battleships at once. The work will be done without Government assistance.

LOCOMOTIVE DESIGN.

The Working Stress of Materials.

By Francis J. Cole.

One of the problems in designing machinery, which requires experience and good judgment, is the determination of the proper working stress of the various parts, and of the different kinds of material used in its construction and with one or two exceptions, there is no class of machinery to which this applies with so much force as to the locomotive. The complex strains to which many of the parts are subjected, caused by running at high speeds over uneven tracks, the fact that the boiler is part of the moving machine, the necessity for carrying the whole structure on springs, and other causes incident to its operation, all tend to render the conditions and stresses more than ordinarily involved.

The ideal engine, as regards durability, is one which would show no decrease of power, no structural weakness, but a gradual decadence, a lack of economy in operating, rather than any local debility, causing its final consignment to the scrap heap.

For several years the breakages causing delays to trains, on a railroad operating between 800 and 900 locomotives, were reported systematically to the writer. Those due to improper design, structural weakness or poor material were investigated, and the stresses to which the broken parts were subjected were carefully studied. Experiments were made and remedies proposed which nearly always resulted in a marked

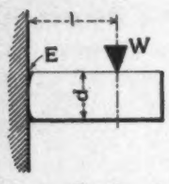


Fig. 1.

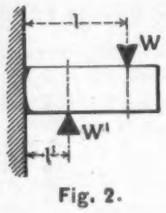


Fig. 2.

decrease of breakdowns when the conditions admitted of a prompt renewal of the weak parts. This did not always take the form of more metal or even better material, but often in a more suitable design to resist the strains to which the member was subjected.

The working stresses in locomotive parts have a wide range, the maximum being found in elliptic springs at about 80,000 pounds and the minimum in spring hangers at about 4,000 pounds per square inch. When the suitable working stresses are determined it is a comparatively easy matter to design the parts and these articles will treat of a few of the most important parts, with suggestions as to working stresses for each, founded on the forces involved (many of the forces are unknown and cannot be calculated) and adapted to the functions of those parts, with a view of designing them so that they will not be large and clumsy, or, on the other hand, too light for the service required.

Crank Pins.

What are the proper proportions for locomotive crank pins? If we use the dimensions of pins of engines in actual service and calculate their fibre stresses, a range, much greater than good practice would indicate, will most likely be found to exist. Unless a comprehensive investigation is made, and the question analyzed at some length, the limits of size and of maximum fibre stresses may not be clearly discerned among the erratic dimensions and proportions produced by guess work and empirical designing. From 8,000 to 29,000 pounds fibre stress per square inch have been found in locomotives built by different makers, in crank pins other than the short front or back ones used on mogul, ten wheel, consolidation or on types where the rod comes close against the hub of the wheel. In the latter cases the size is determined by the bearing surface, the lever arm or distance from the center of the rod to the wheel being so short that the bending of the pin need not be considered. The stress on any crank pin can be easily found by regarding it as a circular beam fixed at one end, and loaded at the other, with or without the support or counter moment of a rod between it and the wheel or outside. The section modulus or moment of resistance for solid circular sections $=\frac{\pi d^3}{32}$ reducing to $0.0982d^3$. The extreme fibre stress at E, Fig. 1, with a single load W is, $S=\frac{W\,l}{0.0982d^3}$, in which:

W=the weight, load or push in pounds.
l=the length to center of W in inches.
d=diameter.
S=maximum fibre stress per square inch.
R=section modulus.

Then: $d=\sqrt[3]{\frac{W\,l}{0.0982d^3}}$ $\qquad R=\frac{W\,l}{S}$

Taking for example a ten wheel or mogul engine where the main rod is outside the parallel rods, the fibre strain for the assumed dimensions will be as follows:

Cylinder 20 inches diameter, steam pressure 180 pounds, distance l from face of hub to center of cylinder, eight inches, diameter of pin at hub or wheel fit six and one-half inches.

Then: $S=\frac{W\,l}{.0982d^3}=\frac{20^2\times.7854\times180\times8}{.0982\times6.5^3}=16{,}766$ pounds.

This is the maximum stress due to the steam pressure which the crank pin is required to bear. If, however, the cylinder compression runs up above the boiler pressure or water is allowed to accumulate, the stress at the ends of the stroke will be greater. Normally, the entire thrust of the piston multiplied by the lever arm "l" is not the true bending moment, as the support of the parallel rod must be considered.

Fig. 2 shows this condition, with the support or counter moment W^1. The primary bending moment when $l^1=3\frac{1}{2}$ inches will be two-thirds the total thrust of the piston multiplied by $3\frac{1}{2}=\frac{W\times2\times3.5}{3}=131{,}880$ pounds. This is shown in Fig. 3.

The main rod transmits 56,520 pounds to the end of the main crank pin, one-third or 18,840 pounds is dropped off at the main wheel, one-third is transmitted to the front and one-third to the rear wheels though the parallel rod. The actual bending moment is 452,160—131,880=320,280 pounds. The actual working fibre stress then of the crank pin is $\frac{320{,}280}{26.96}=$ 11,880 pounds. In all engines of the ten wheel, mogul, consolidation, or any type with the main rod on the outside, the main pin is the only one which need be calculated for bending. If the bearing surfaces of the other pins approach reasonable sizes, the strength, owing to the shortness of the lever arm, will be more than sufficient.

In eight wheel engines of the American type, in which the main rod is next the wheel, the greatest stress is on the back pin, the main pins rarely breaking in service. The reason is apparent upon an examination of Fig. 4. For a 17 inch cylinder and steam pressure of 180 pounds, the piston thrust equals 40,860 pounds. Distance from center of main rod to face of wheel $2\frac{1}{2}$ inches, from center of parallel rod to wheel $7\frac{1}{8}$ inches. The bending moment for the main pin, due to the thrust of the main rod, is $40{,}860\times2.5=102{,}150$ pounds. The bending moment from the reaction of the parallel rod is $\frac{40{,}860\times7.125}{2}=145{,}563$ pounds. Then $145{,}563-102{,}150$, or 43,413 pounds, is the actual bending moment. On the back pin, owing to the absence of any support, the bending moment is much greater, as it must bear the entire pressure of

half the piston thrust, multiplied by the distance from the center of the parallel rod to the wheel hub. This is $\frac{40,860 \times 7.125}{2} = 145,563$ pounds. It is a well known fact that the back pins on this type of engine break much more frequently than the main pins, owing to the prevailing and erroneous custom of making the wheel fit diameters the same for both pins, basing the size on the requirements of the main pin. It is evident that the maximum fibre stress is much greater in the back pins.

The section modulus for any solid circular section from 1½ to 9 inches diameter is given in diagram Fig. 5; by following the vertical lines from the figures at the base line, corresponding to the required figure to its intersection with the curved line, the diameter for a given fibre stress can be obtained without any further calculation, or vice versa, for a given diameter the section modulus for that size is shown.

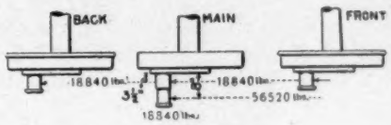


Fig. 3.

For a good quality of steel, having an ultimate strength of about 80,000 pounds, with a minimum elongation of 18 per cent. the working stress (taking into consideration the support or influence of the parallel rod), should not exceed 14,000 pounds for locomotives having the main rods outside, the range probably being from 12,000 to 14,000 pounds, and 12,000 pounds for locomotives having the main rods inside the parallel rods,

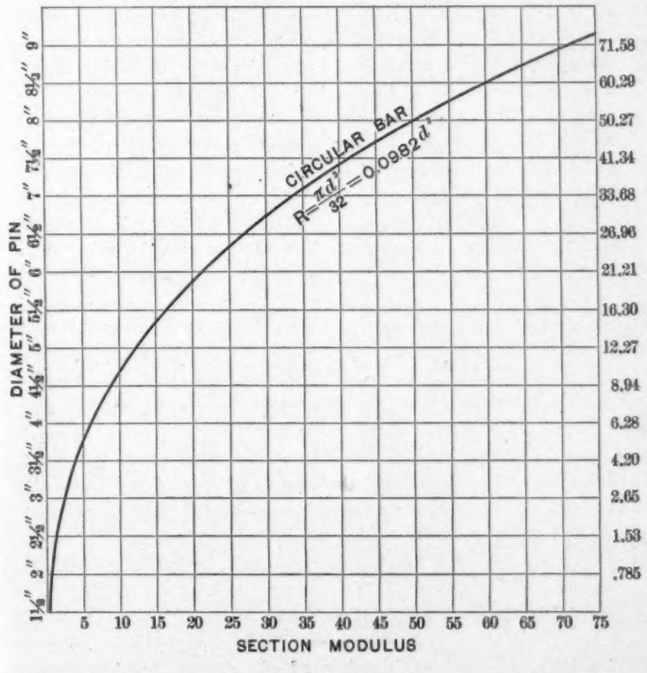


Fig. 5.

with a range of from 10,000 to 12,000 pounds. For hammered iron 11,000 to 12,000 in the first case and 9,000 to 10,500 pounds in the second. If these limits are exceeded by 25 or 30 per cent. breakages are liable to occur in time. A number of instances to support this statement could be cited, showing that the margin of safety is quite small. The liability to exceed the figured stresses is due largely to the variation in the adhesion on the track of the different wheels, with sand under the rear wheels and the main resting on a slippery part of the rail, the force transmitted to the back pins will be considerably increased. It is also liable to be increased above the normal by the non-parallelism of the rods, caused by the cranks varying from the quarter or 90 degree point and improper adjustment of the wedges in the frame pedestals, causing a difference in length between the rod and the axle centers.

The range of working stresses is graphically shown in Fig. 6. The area enclosed between the curved lines marked 15,000 and 12,000 pounds, shaded with horizontal lines, represents the "working field" or range of stress which it is advisable to use for crank pins for ten wheel, mogul, consolidation, or any type having the main rod outside the parallel connecting rod as shown in Fig. 3. Similarly the area between the lines marked 12,000 and 10,000 pounds, shaded with vertical lines, represents the limits for engines with the main rod inside the parallel connecting rod (Fig. 4). This diagram gives the diameter of crank pins for fibre stresses between 10,000 and 15,000 pounds. The bending moments are given in inch pounds, that is, the force or pressure on the pin multiplied by the distance in inches, of the center of the rod to the wheel hub.

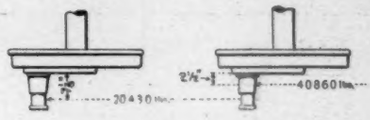


Fig. 4.

The simplest method, which is also a satisfactory one, is to disregard the support of the parallel rod, and use for steel of good quality a stress of 15,000 pounds for freight engines and 11,000 pounds for passenger engines, under the conditions of position of main rod as before described. Thus, for a 19 inch cylinder freight engine, 180 pounds of steam, 7½ inch lever arm (center of rod to wheel hub), the bending moment would be $283 \times 180 \times 7.5 = 382,050$ pounds. Following the horizontal line corresponding to this figure to its intersection with the curved line marked 15,000 pounds, and then down the vertical line to the base, the diameter, 6⅜ inches, will be found. For the diameter of a rear pin for a passenger engine having the same dimensions, half the amount only would be transmitted through the parallel rod to the back pin or $\frac{382,050}{2} = 191,025$. Following the horizontal line along to its intersection with the curved line marked 10,000 pounds, and then down the vertical line to the base, the diameter 5¾ inches is found. In the first instance (freight engine) the force on the main pin is not greatly increased by any variation in the coefficient of adhesion, hence the use of the higher stress. In the second (passenger engine) the force transmitted to the rear pin can be largely increased by a variation in the adhesion of the main and rear pair of wheels.

(To be continued.)

Coal records are to form the basis of the relative standing and promotion of the enginemen on the Wabash Railroad, according to a circular, a copy of which has been received from Mr. George M. Burns, fuel agent of the road. After announcing this fact, the circular explains the use of a new coal ticket and urges men to exert themselves to stand at the head of the list, and shows the importance of careful attention to the admission of air under the grates, continuing as follows: "Engineers should use good judgment in the use of the injector, as economical firing cannot be done unless water is supplied to the boiler regularly. Attention is also called to the importance of using the feed water heater, as by that means warm water is supplied to the boiler, thus saving considerable heat energy. Water in tenders should be heated to from 70 to 90 degrees before leaving terminals. The injector heaters should be used to prevent popping off and at the same time to assist in heating water in the tender." The loss of fuel by blowing at safety valves is troubling many mechanical officers, and they will probably be glad to have attention again called to the possibility of utilizing this heat in the feed water.

(Established 1832.)

AMERICAN ENGINEER
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BY
R. M. VAN ARSDALE,
MORSE BUILDING..... .....NEW YORK

G. M. BASFORD, Editor.

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Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING PAGES. *The reading pages will contain only such matter as we consider of interest to our readers.*

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Contributions.—*Articles relating to railway rolling stock construction and management and kindred topics, by those who are practically acquainted with these subjects, are specially desired. Also early notices of official changes, and additions of new equipment for the road or the shop, by purchase or construction.*

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Why is it with all the technical schools preparing young engineers that one of the leading trunk railroads, and a large car manufacturing concern, as shown by correspondence in this office, have difficulty in securing satisfactory draftsmen?

A unique series of very valuable illustrated articles on the practical subject, "Locomotive Design; The Working Stresses of Material," by Mr. F. J. Cole, begins in this issue. The articles are written by a well known mechanical engineer, who has not only had years of experience in the designing of locomotives and their details, but has also personally watched the effects of good and bad designing. The articles need no preface at our hands, but that something of this sort is sorely needed in many quarters is shown by a remark made by Mr. L. R. Pomeroy at a recent meeting of the Western Railway Club, to the effect that a consolidation engine with 180 pounds boiler pressure and 19 by 24-inch cylinders had come to his notice, the main crank pins of which were only ¾-inch larger than are used on the elevated roads of New York. He further stated that after calculating the fibre stresses of many crank pins he had found them to run over 25,000 and 28,000 pounds per square inch, and the same thing was true of axles. The subject is one that will always be important, because of the influence of good designing in reducing the cost of repairs and the losses due to breakdowns on the road. All roads are following up the matter of engine failures and we are confident that the careful work that Mr. Cole has done will be valuable to a great many of our readers. We do not know of any other systematic, thorough treatment of this subject to be found in print.

A valuable suggestion is made by "Motive Power" in this issue when he says that he knows of "no reason why each department should not be made to pay its own expenses, and frequently it becomes purely and simply a question of improved facilities to be used in preference to the facilities then in service." In successful commercial engineering work, departments that do not pay are made to pay or are cut off, and it has been noted in these columns that sometimes very expensive machinery is sacrificed in order to give place to that which will turn out the product at reduced expense. An example is known in which tools valued at $40,000 were laid aside on this account. There is much in commercial practice that should be copied in railroad work, one principle being a consolidation of the work of one kind at one point. There are few roads small enough to permit of concentrating all of the repair work to rolling stock at one place, and the tendency has been to erect complete shop plants at various convenient points along the line, the chief difference between the plants being as regards their size. Of late the idea of specializing these shops to a certain extent has been growing, and for work requiring expensive machinery, it has been found desirable to provide sufficient capacity for the special work of one kind for the entire road at one of the shops. A good example of this is seen in the installation of a large hydraulic riveting plant at the Chicago shops of the Chicago & Northwestern Railway, and it is recognized as highly important that such machinery should be kept in constant use in order to make it earn its living. This idea has not been carried as far as it may be and ought to be, and particularly with regard to small work, of which a great deal is ordinarily done about railroad shops. A case in point is a road with two large shop plants, each being equipped with a rather elaborate brass working department, while there is not work enough to keep one of them in continuous service. A close cost-keeping record would soon show the commercial weakness of such a plan, and we believe that a system of accounting for the cost of work done in each department would pay for the clerical expense many times over. The money invested in a number of ordinary brass working tools might better be spent upon a single effective equipment, and in general it may be said to be a good plan to concentrate the work that may be called "standard" at one point when it is possible to do so.

ELECTRIC CRANES vs. TRANSFER TABLES.

The most convenient location of pits in locomotive repair shops was discussed at the January meeting of the Western Railway Club, and while preferences were expressed for each plan, the longitudinal, and the cross tracks, yet no good reasons were given for the use of the latter. The transfer table is such a familiar device and shop men are so accustomed to its use that it has come to be regarded as an actual necessity, even when provision has been made for moving locomotives by power inside the building. The Bloomington shops of the Chicago & Alton, the Grant Locomotive Works, and the Burnside shops of the Illinois Central, are illustrations of this fact. Each of them has overhead power cranes of sufficient capacity to lift a complete locomotive and transfer it. Yet they have cross tracks, each with an outdoor opening,

leading to a transfer table and pit. The Boston & Maine shop at Concord, N. H., which we have recently illustrated, is a good example of the longitudinal plan, for here the erecting shop and the boiler shop also are served by the same cranes, and no transfer table is required. Climatic conditions doubtless determine that at Concord the number of outdoor openings should be limited, and that a snow-covered transfer table and pit should, if possible be avoided.

We believe that the advantages of the longitudinal plan have been so well demonstrated in a number of recent shops that we hardly see how it is possible that any more locomotive repair shops with transfer tables can be built. The disadvantages of the transfer table and pit are that they occupy valuable room which cannot be used for anything else. They make an ugly break in the communication between the shops and render it difficult to cross them by men or material. They can only serve a limited purpose of shifting engines sidewise from one track to another, and they serve no useful purpose in lifting material as does the equivalent transfer crane inside. Overhead cranes may be regarded as transfer tables, placed inside and overhead, and while they perform the only function a transfer table is capable of, they are also in constant requisition for lifting the heavy details of the engines.

For these reasons we cannot understand how there can be any question of a choice between transfer tables and overhead cranes, nor can we understand why, in these days, a new shop should be so planned as to require both. For a man who has long been accustomed to transfer tables, and who is about to plan a new locomotive repair shop, it seems necessary that he make a scientific use of his imagination and get outside of himself. It is only in this way that we can produce original plans which take advantage of the numerous facilities which modern progress so richly affords.

If we are mistaken in regard to the statement that transfer tables for modern locomotive repair shops are obsolete, the advocates of such plans will do us a favor if they will state their advantages, so that we, and our readers, may have a better understanding of the case.

RUBBER HOSE SPECIFICATIONS.

The importance of obtaining good air brake hose is now appreciated more than ever before and there is an increasing dissatisfaction with present methods of guarantees and tests. Last year the Master Car Builders' Association appointed a committee to report on the subject and to consider the prevailing conditions connected with the manufacture and use of air hose and the necessary requirements to insure its being properly made, which is an indication that physical requirements alone are not considered sufficient. It has been customary to subject hose to high-pressure hydraulic tests and accept or reject it upon its ability to meet them. It is now admitted that the pressures were carried absurdly high. Durability is the important commercial requirement with all rubber products and there is no doubt that more attention must be paid to the structure and construction of the hose. It is probable that the report of the committee will give special attention to these features. It has been found most difficult the world over to frame satisfactory specifications for rubber goods and to arrange tests from which intelligent comparisons may be made. This applies to many uses other than those made by railroads, and the reason appears to be that it is difficult to predict the effect of time and service, because of the fact that rubber, unlike steel or iron, has a certain life which is very dependent upon the manufacture of the goods.

Pressure tests, if applied at all, should be used merely to insure perfection of structure and action of the hose under stress, and it might be well to specify limits of expansion under definite pressures. The high-pressure requirements have had a bad effect upon the product, and should not be perpetuated. They are not only useless, but objectionable, for the reason that, to get high hydraulic strength, heavy, closely woven duck is used, and this not only renders the hose stiff, but it shortens its life by deterioration. The reason for this is that in coating the duck with rubber in the "friction" process the rubber ought to be squeezed entirely through the meshes of the duck, so that both sides of the fabric are protected by rubber. Proper frictioning has much to do with the life of hose and its structure as a preparation for severe service. The duck, if improperly protected by the rubber, deteriorates very rapidly, and its adhesion is also adversely affected.

It is comparatively easy to test short lengths of hose for flexibility by adjusting weights and measuring deflections. Chemical requirements may also be stated and also tensile tests of the rubber may be made. In this connection it is interesting to note that for hose used in the navy yards the government requires that a piece of rubber cut lengthwise of the lining, one-half inch wide and four inches between the jaws must stretch to four times its own length (with a variability of 4 inches more or 2 inches less) with a pull of ten pounds, and it must be capable of stretching to six times its own length with an increased pull, without breaking; and when released the rubber must return in one minute to within one-half inch of its original length of four inches. These requirements are not severe enough for air brake hose and one of the prominent hose manufacturing firms voluntarily makes its own specifications much more rigid than these, and adapts them to the special service of railroads.

Considerable attention has been given to the pull required to unwind the duck of hose and it is possible to specify the pull and time required to unroll a section. The quality and weight of the duck and the rubber, the method of making the inner tube, the "friction" of the duck, the number of "ply" and chemical constituents may be specified, but after considering all of these items the hose will not be worthy of confidence unless made by honest people. Of this anyone may convince himself by spending an hour or two in watching the process of manufacture. The best solution of the whole difficulty, as we understand it, is to purchase from reliable manufacturers and not skimp the price.

ELECTRIC POWER DISTRIBUTION IN SHOPS.

An illustrated description of the power distribution system of a large shop plant is given in this issue. The plan described is very interesting and it also serves to call attention to the fact that railroads have been far behind manufacturing concerns in the matter of power distribution. It is not likely that new plants will be planned without electric distribution, and from present indications many existing shops will probably be remodeled to obtain the benefits of this system. Mr. George Gibbs' admirable paper on this subject read last month before the New York Railroad Club is opportune and every mechanical and managing railroad officer should read and study it, for it is by far the best presentation of this subject that we have seen, and it was written with special reference to the conditions of railroad work.

The efficiency of the transmission system is important in its way, and while it is generally conceded that the advantage lies with electricity, this is relatively unimportant when it is considered that the cost of power is but a very small proportion of the whole cost of shop work. Mr. Gibbs puts it at 2 per cent. of the labor cost and shows that the saving in cost of power from improved transmission is but a small proportion of the saving that may be had by increased labor efficiency and greater convenience. This is illustrated by the statements made by him that the cost of installation of an electric motor to drive a turn table at the West Milwaukee shops of the C., M. & St. P. Ry., was saved in labor in four and one half months, and that the cost of the entire electric motor equipment at the Baldwin Locomotive Works, costing between $60,000 and

$70,000, pays for itself every year. Some of this is due to better efficiency, but most of it to improved labor conditions. These are the results that managers want to know and the paper gives a great deal of information as to how the results may be obtained.

The Boston and Maine application was carefully planned with special reference to labor charges. The boilers for all purposes are in a single battery and are tended by a single fireman. The engine, air compressor and generators are in one room, which is an ideal arrangement, and in the only case where direct driving could be used it was used, viz., to drive the planing mill, yet the engine for that purpose is in the power house and drives a shaft through the wall of the building. With such concentration of steam power a condensing system with a cooling tower could probably be used to good advantage, and it would undoubtedly increase the economy of the plant especially where live steam is used for heating.

There is no longer reason to regard electrical machinery as complicated, and attention is called to the extreme simplicity of the induction motors used at Concord. They have no commutators or brushes; they are as simple as a grind stone or emery wheel, and apparently need only to be oiled and otherwise let alone in order to work satisfactorily.

There are many interesting problems in connection with electric driving, such as the best transmission system, the most favorable grouping of machinery and the selection of motors. Authorities differ on many of the details, but one of the best features is the flexibility which permits of experimenting indefinitely until the right arrangement is secured. As we understand it, the matter of first importance is to arrange the plant with special reference to reducing labor charges to the lowest terms.

NOTES.

Switzerland proposes to buy all of its railroads at a cost of about $200,000,000. The people have voted in favor of the plan, and efforts are now being made to arrange a loan.

The Holland submarine boat has been successfully tried in New York harbor and no difficulty was found in running while submerged, or in remaining at a depth of 14 feet for a half hour. Trials in deeper water are to be made.

Three new battleships and new dry docks at Portsmouth, N. H., Boston, Mass., Algiers, La., Mare Island, Cal., besides the enlargement of the dry docks at League Island, Philadelphia, were authorized in the report of the House Naval Committee. The cost of the battleships is to be $6,000,000 each.

A reversible steam turbine has been sought for by those most interested in that type of steam engine, the earlier ones being reversed by a special turbine so constructed as to run in a direction opposite to that of the main engines. It is now stated upon good authority that Mr. Parsons has solved the problem by an arrangement of valves whereby the steam may be driven through the blades of the wheel in either direction and the entire power of the turbine be utilized in driving in the reverse direction.

Stand-pipes, instead of wooden tanks are used at a number of water stations on the Chicago, Rock Island & Pacific Railway. They range from 30 to 130 feet in height and from 12 to 30 feet in diameter. These stand-pipes are considered cheaper than the wooden tanks and it is thought to be more advantageous to rest these stand-pipes on the ground and make them high enough to give sufficient head than to elevate the bottoms of the tanks. A part of the storage space of the stand-pipes is not available for giving a head, but this method is found cheaper than the other.

The special train by which the Government sent the Alaska relief expedition from Jersey City to Seattle made the trip of 3,139 miles in 129 hours, or at a speed of nearly 25 miles per hour across the continent, which is remarkable for freight train speed. The Pennsylvania took the train to Chicago and the Chicago, Milwaukee & St. Paul took it to Minneapolis, where it was delivered to the Great Northern for the run to Seattle. There were 38 cars in the train, 19 in each section, and of these ten were occupied by the Laplanders and three were filled with moss, which was to feed the reindeer until their arrival in Alaska.

The magnificent showing made by the Pennsylvania Railroad in its annual report is a most encouraging feature in the business world. There were exceedingly heavy expenditures during the year, calling for almost two million dollars to be reserved for unusual work, but in spite of this a five per cent. dividend was paid, and an eight per cent. dividend was earned besides meeting all fixed charges. There was no increase in the bonded debt, but some of the bonds bearing a high rate of interest were refunded at lower rates. This road is a great commercial thoroughfare, and that it is in such excellent condition is reason for congratulation the country over, because of the reflection of good business conditions which is shown.

In commenting recently upon the punctuality of American trains in the London "Times" Mr. W. M. Acworth said: "If I were to give in one sentence, the reason why American trains in spite of great difficulties are excellently punctual, I should say it was because punctuality is insisted on. Instead of engines being sent out, as often happens here, with trains that they are evidently and notoriously incapable of hauling to time, engines are built powerful enough to play with their trains. I stood one night on the platform of the huge Union depot at St. Louis, where the trains of 22 different companies converge, and watched one express after another start out. Many of them weighed at least 400 tons, most of them certainly over 300. Yet not once did I see a driving wheel slip at starting."

Mr. Frederick A. Delano, Superintendent of the Chicago terminals of the Chicago, Burlington & Quincy, gave the tenth lecture in the series of addresses on railway subjects before the engineering students of Purdue University, March 9. His subject was "Railway Signaling." After carefully classifying such signals according to their form and the purpose for which they are employed, Mr. Delano confined his attention to a discussion of the fundamental principles affecting the operation and interpretation of fixed signals. He traced the historical development of the signal idea, discussed the larger and more general questions involved, and disclosed the tendencies of present practice. The lecture was illustrated by means of models and diagrams, which will be given in connection with the text as finally published by the University.

The Crowden system of hydraulic jointing of bicycle tubes is one of the most promising of recent mechanical improvements, and while its widest field is in the construction of bicycle frames the process may also be used for other purposes. Briefly stated the process for making the joints in tubular bicycle frames employs a jig, into which the bicycle frame fits closely. At the joints grooves are cut in the jig with right and left handed spirals crossing each other. The joints are made by applying hydraulic pressure to the interior of the tubular frames, which presses the tubes at the joints into the grooves, and as the metal is strained beyond its elastic limit in the grooves it remains in the form given by the jig. The frame is not distorted by the pressure except at the joints, because of the support given it by the close fitting jig. This process is likely to work a great change in the manufacture of bicycles, and its best recommendation is that heat and brazing are not necessary. It is the invention of Charles T. Crowden, who has obtained patents upon it. Another wide field may be found for it in the fixing of tubes in boilers.

Communications.

PRIZES FOR STATION AND TRACK PLANS FOR SWEDEN.

Editor American Engineer:

The Royal Administration of the Swedish State Railways invites civil engineers or other interested parties to a competition of designs for the arrangement of new Railroad Stations, etc., for the City of Stockholm.

The first prize is to be 12,000 Swedish crowns (about $3,230); the second, 8,000 Swedish crowns (about $2,150), and the third, 4,000 Swedish crowns (about $1,075). The time for competition will expire at noon on the 31st of August, 1898.

Particulars concerning the nature of the work will be furnished by the Swedish-Norwegian Legation, 2011 Q street, Washington, D. C., or by the Vice Consul of Sweden and Norway, Mr. August Peterson, LeDroit Building, corner F and Eighth streets, Washington, D. C. Security to the amount of $13.50 for the use of the drawings in this competition is required, but this will be refunded when the drawings are returned.

It is hoped that American engineers will carry off some, if not all, of the above generous prizes.

AUGUST PETERSON,
Vice Consul, Sweden and Norway.

Royal Swedish and Norwegian Vice-Consulate,
Washington, D. C., March 12, 1898.

AMERICAN LOCOMOTIVES FOR RUSSIAN RAILROADS.

Editor American Engineer:

The Baldwin Locomotive Works have in St. Petersburg the most active resident agent that any American firm has in this country, Mr. T. J. Gordon. The said agent has sold lately for his firm three tank engines, each of 36 tons, for the Arekhof branch railroad, and 14 freight engines, Class E, Vauclain System, and three Baltimore & Ohio type, ten wheel passenger engines for the South Eastern Railroad Company. Of the last mentioned type 60 engines are already running on the Russian Moskow-Kursk line and have given splendid results.

Mr. Gordon has just closed a contract for 20 freight engines, class E, for the new Moscow-Riga Windau Railroad, now under construction. The engines are similar to the 80 engines sold lately to the Vladicaucas Railroad Company.

For the past 20 years Mr. Gordon has been introducing American locomotives, and has built up the Baldwin trade in this country. He has a large and, in fact, the only American interest to-day in the Nicopol-Morioupol Mining and Metallurgical Company, of which Mr. Henry Laud, formerly with the Illinois Steel Company, of Chicago, is the general manager, and Mr. Julian Kennedy, Pittsburg, is the consulting engineer. More particulars about the Marioupol works, constructed by the company, will be given in a following letter.

Another business controlled by American capital is the Sormovo Works, which have established a locomotive department. All their new machinery has come from the United States, and the manager of this department is Mr. Walter F. Dixon, from Paterson, New Jersey. This plant has been established only lately, and has up till now only turned out three locomotives, but the capacity is to be in future 70 engines per year. Mr. Gordon is a stockholder in the Sormovo company.

I was also informed that Mr. Gordon will be shortly in the United States, placing orders for machinery.

A. ZDZARSKI,
Assistant Chief Engineer Great Siberian Railway.

St. Petersburg, February 24, 1898.

ACETYLENE CAR LIGHTING IN CANADA.

Pontiac Pacific Junction Railway Company,
General Superintendent's Office,
Ottawa, Ont., March 11, 1898.

Editor American Engineer:

In answer to your request for information relating to our use of acetylene, I beg to advise that we have been experimenting with acetylene gas for car lighting, and have decided to equip our cars on both roads with this gas. Under the old system of oil lighting our coaches the 14 light chandeliers gave a poor light; under the acetylene gas system we use but five lights in the body of the coach, and with most satisfactory results, being a far better light than electricity or any gas light now used in coaches in the United States or Canada. I believe we are the first road to inaugurate this system.

In conversation with the local agents for the Niagara Falls Acetylene Gas Generator, the Messrs. Holland Bros., of Ottawa, Ont., I suggested that acetylene gas would be a splendid lighting element for the railway cars, if it could be utilized without danger. Mr. Andrew Holland, one of the proprietors, asserted positively that he could light the cars safely and brilliantly with one of the generators used for house lighting. The problems to be met were:

First: The effect of intense frost, on the gas machine and on the gas when piped between cars with rubber hose, and when the train was running 30 or 40 miles per hour with the mercury away below zero.

Second: The effect of vibration of cars on rough track on the steadiness of light.

Third: The danger of gas escaping from the generator by the agitation of the water in the gas tank.

Fourth: The slopping over of water from the gas tank on floor of car, and in consequence, smell of escaping gas.

Shortly after this conversation I placed the train at Messrs. Holland Bros.' disposal for equipment. A 20-light generator was installed in the baggage car. The cars were temporarily piped for gas fixtures, and the first trial decided that three of the expected difficulties amounted to nothing in actual work—the tank and the gas were not effected by the frost; the lights were not effected by the vibration of the cars, and the illumination was more brilliant than on any train I have ever seen. I believe it to be the most brilliant light used to-day on any train in the United States or Canada.

On through mixed express trains, such as we run on this line, with all the drawbacks of shunting, causing slopping over from the water tank, during our first experiments, the light is so ahead of anything that we have yet seen in economy and convenience that we shall never revert to the oil system of lighting. But where a train has to be broken occasionally and cars shunted, it can readily be seen that such a system could not be worked. Here, again, Messrs. Holland Bros. came to our assistance, and have installed a plant for use in our coaches that requires less carbide and avoids slopping and smell from gas, and is positively safe, because the gas is only generated in such small quantities under low pressure that the amount generated at any one time, if such a thing could happen, an explosion would not break a pane of glass. If the cars were to turn over the lights would go out, and the gas would simply pass away harmlessly into the air, as no fire could possibly result from it. The plant is installed in the toilet room, and it occupies a floor space of about 14x26 inches. Those generators have a capacity for the lighting of six lights of 50-candle power each. The charges in attendance of these generators are so simple that an ordinary chore boy attends to ours without any difficulty or danger. We propose to equip all our cars with the acetylene gas plant, as being the cheapest, safest and most brilliant illuminated for railways yet discovered. The carbide we use is manufactured by the Wilson Carbide Co. of St. Catherines, Ont. It costs $60 per ton f. o. b. factory, and the lighting of one of our coaches with this light enables the passengers to read their evening papers from any seat in the car, and costs about 25 cents for a six hours' run.

P. W. RESSEMAN,
General Superintendent.

POOLING LOCOMOTIVES.

Editor American Engineer:

On page 54 of your February number is an article on pooling of locomotives, in which this sentence appears: "It is clear that the advocates of pooling have as a rule considered what may be termed the business questions of operation." This is really the kernel of this whole question, and as an advocate of the pool with twelve or thirteen years' experience in handling engines under this system, I wish to emphasize the sentiment expressed in this sentence.

An ideal method of handling engines would seem to be one that not only makes it possible, but practicable and convenient,

to handle motive power with no thought except that of maximum service and economical operation. The ideal method makes it possible to assign engines to this or that train, to run them "last in first out," or "first in last out;" to hold in or send out any engine at any time; to transfer them from one division to another at pleasure; to lay up during periods of dull business all engines that cannot be kept in constant service; to insure opportunities for engine crews to secure the proper rest at all times; in fact, to secure a maximum amount of service with a minimum of power, and at the same time automatically conserve the "rights" of all enginemen, and I know of no system that comes as near securing all these results as pooling. A well regulated pool will of itself secure just these results, and in my experience with regular crews any attempt to follow out some of the ideas advanced would have caused the round house foreman to ask with all seriousness, "Is life worth living?" Any one familiar with the work knows how often great inconveniences and unnecessary expense have been incurred in order to get certain engines and crews out in "their turn" with the regular crew system.

I would like to call attention to a few points in the discussion of this subject at the December, 1897, meeting of the Western Railway Club. On page 146 Mr. Brown says: "According to the business and the mileage made extra crews are added. These extra crews are not compelled to wait for some one to lay off before they can make any mileage, but they run in rotation on all of the engines in their turn, so that the mileage of the extra men will be substantially the same as the men favored with regular engines. According to the business done, the regular crew will make two or three round trips; they are then taken off for one trip and lay in until 'their turn' for rest and recreation."

Here we have a pool pure and simple, with the most essential element left out, that of insuring absolutely and automatically an oportunity for each crew to secure rest after each and every trip. The regular crew, he says, "will make two or three round trips and are then taken off." It is evident that the successful working of this arrangement would require that each trip represented a definite and somewhat uniform amount of work, while the facts are there is nothing more indefinite or uncertain than this very item, hence the evident element of weakness of this method.

Another argument against pooling is the "home instinct." It is this very home instinct that makes the difference in the tonnage hauled, the miles run, the cost of repairs, etc., between the pool and regular crews. We invest in a home, not usually as a business venture, but as a matter of comfort, and it is in our homes we expect to secure that comfort or perhaps luxury and ease which are entirely separate and distinct from our business life; so with the engineer, if he comes to look upon his engine as a home, rather than a machine from which he is expected to secure the maximum output, he will quite likely be much interested in arranging for his personal comfort with just the results claimed in the letters from the superintendents, quoted in the paper referred to, where it is stated that much heavier trains were hauled by the same engines in a pool than with regular crews.

In 1886, when air brakes had been in use on freight trains for many years, the first Burlington brake test demonstrated that they were probably worse than hand brakes. Were air brakes on freight trains abandoned for this reason? Not by any means. They were developed and perfected with results too well known to need comment. Such is the history of nearly all progress. The pooling system is no exception, and, as mentioned in the opening remarks on the paper on pooling, less than eighteen months or two years should not be considered sufficient to get a pool into good working order, and even then it requires the honest and enthusiastic support of those who have to do with it, and not the lukewarm, half-hearted endorsement which is sometimes given to changes which do not meet with immediate personal approval.

A case of failure of this system twenty-three years ago is cited. At that time the locomotive was not built to require the minimum of adjustment and running strains as it is to-day. Much stress is laid on the care of the machine by the engineers, but it is really difficult to see just what real work an engineer can do on an up-to-date engine, with solid end side and main rods, fixed wedges or driving box bearings, metallic packing at all steam joints, automatic oil feeds for all bearings, including driving and engine truck journals.

Notwithstanding the testimony of those who have never tried pooling, I must after many years of experience remain firm in the faith. R. H. F.

March 11, 1898.

Personals.

Mr. Richard English has resigned as General Master Mechanic of the Santa Fe Pacific, to take effect March 21.

Mr. Hugh J. Jewett, ex-President of the New York, Lake Erie & Western, died at Augusta, Ga., March 6.

Mr. Dwight C. Morgan has resigned as Assistant Engineer of the Illinois Central Railroad, a position which he has held since last August.

Mr. William R. McKeen, Superintendent of the Car Department of the Vandalia shops at Terre Haute., is reported to be about to retire.

Mr. A. M. Stimson, Purchasing Agent of the Cleveland, Cincinnati, Chicago & St. Louis, died in Lafayette, Ind., March 8, after a brief illness.

Mr. T. A. Davis, Master Mechanic of the Wyoming Division of the Union Pacific, has removed his headquarters from Laramie to Cheyenne, Wyo.

Mr. George L. Bradbury, Vice-President and General Manager of the Lake Erie & Western, has been chosen President of the Peoria & Pekin Union.

Mr. C. M. Bissell, general manager of the Findley, Ft. Wayne & Western, is reported to have tendered his resignation, and will be succeeded by Mr. George Chapman.

Mr. W. D. Tyler, President and General Manager of the Washington & Columbia River Railway, has resigned his position owing to the sale of that road to the Northern Pacific.

Mr. Theo. H. Curtis, who has been chief draftsman of the New York, Chicago & St. Louis Railroad, has been given the title of Mechanical Engineer. His Office is at Cleveland, Ohio.

Mr. W. C. Halliday, formerly with the Lake Shore & Michigan Southern, has been appointed Chief Engineer of the Tacoma & Columbia River Railway, with headquarters at Tacoma, Wash.

Baron Ludwig von Erlanger, for many years principal owner of the Alabama Great Southern and other lines of the Queen & Crescent system, died at his home in Frankfort, Germany, February 15.

Mr. George Hargreaves has resigned his position as purchasing agent of the Chicago, Burlington & Quincy Railroad to accept the vice-presidency of the Michigan-Peninsular Car Company of Detroit.

Mr. W. Fred P. Fogg has resigned as General Manager and William D. Patterson, Treasurer, has been appointed Acting General Manager of the Wiscasset & Quebec, with headquarters at Wiscasset, Me.

Mr. W. J. Calhoun, of Danville, Ill., has been selected to succeed Mr. Morrison as a member of the Interstate Commerce Commission. He is a lawyer of recognized ability and integrity and a strong man.

Mr. P. N. Hyden has been appointed to assist the Master Car Builder of the L. S. & M. S. Ry. at Cleveland. He was formerly with the Pullman Car Works and later with the McConway & Torley Company.

Mr. F. B. Smith, who has heretofore had the title of Master Mechanic of the New York, New Haven & Hartford Railroad, has been given the title of General Master Mechanic. His headquarters are at New Haven, Conn.

Mr. W. A. Stone, formerly master mechanic of the Southern Railway at Selma, Ala., has been appointed master mechanic of the Montgomery division of the Mobile & Ohio, which is now under construction.

Mr. C. G. Herman of Philadelphia, has been appointed Master Mechanic of the Cornwall Railroad, succeeding A. J. Reed, with headquarters at Lebanon, Pa. Mr. Herman was formerly with the Baldwin Locomotive Works.

Mr. Howard G. Kelley, heretofore Chief Engineer of the St. Louis Southwestern, with headquarters at Tyler, Tex., has been appointed Chief Engineer of the Minneapolis & St. Louis, with headquarters at Minneapolis, Minn., succeeding Mr. Charles Wanzer.

Mr. George G. Yeomans has been appointed Purchasing Agent of the Chicago, Burlington & Quincy and proprietary lines, with headquarters at Chicago, to succeed Mr. George Hargreaves, resigned. Mr. Yeomans has been Assistant Purchasing Agent for the past seven years.

Mr. H. L. Noyes, civil engineer, has severed his connection with the Buffalo Bridge & Iron Works and has opened an office at 846 Ellicot Square, Buffalo, N. Y. He will make a specialty of design and inspection of steel bridges and will also represent the Pittsburg Testing Laboratory.

Mr. Joseph McCabe, formerly Superintendent of the Pacific Division of the Northern Pacific, with headquarters at Tacoma, Wash., has been appointed General Manager of the Washington & Columbia River, with headquarters at Walla Walla, Wash., succeeding W. D. Tyler, recently resigned.

Mr. F. T. Croxon has been appointed Purchasing Agent of the Chicago Junction Railway, which was recently formed by a consolidation of the Chicago, Hammond & Western and the Chicago Junction Railway & Union Stock Yards Company. His headquarters will be at the Union Stock Yards, Chicago.

Mr. E. L. Russell, heretofore First Vice-President and General Counsel of the Mobile & Ohio, was on February 28 chosen President of that road to succeed Mr. James C. Clarke, who declined re-election. Mr. Russell has been General Solicitor and General Counsel of the road since 1876, and was chosen First Vice-President a year ago.

Mr. Richard Carroll, formerly General Manager of the Queen & Crescent system, but who has been engaged in other business for three years, has been appointed Vice-President and General Manager of the Mobile & Ohio, succeeding Mr. J. G. Mann as General Manager. Mr. Carroll was connected with the Queen City & Crescent system for nearly 14 years.

Mr. Jules Viennot, who has for many years carried on the business of advertising agent for a number of manufacturers and railroad supply houses, died March 11, at the age of 73 years. After being connected with several trade publications he took charge of the advertising of the Baldwin Locomotive Works in 1878 and from that time added to the number of concerns for whom he conducted advertising until he had built up a large and profitable business. Mr. Viennot came to this country about 40 years ago and by his agreeable personality made many friends. He also had a high standing in business circles in Philadelphia and enjoyed a prominent social position.

General W. S. Rosecrans died at his home in California on the morning of March 11. He was born in Ohio September 6, 1819, and graduated from West Point in 1842 and entered the Corps of Engineers. He was about four years at the Military Academy as Assistant Professor and served on river and harbor work with the corps for some years, and resigned in 1854 to go into business as an architect and civil engineer. He served during the Civil War from the very beginning until the end, having reached the rank of Major-General of Volunteers, and he resigned from the regular army in 1867 with the rank of Brevet Major-General. He served as Minister to Mexico, as a member of Congress from California, and, from 1885 to 1893, as Registrar of the United States Treasury.

SIR HENRY BESSEMER.

Probably no individual has exerted a wider influence upon the progress of the century than Sir Henry Bessemer, who died at his residence near London March 15. He was the son of an inventor and inherited skill in mechanical and metallurgical work. He was an inventor while very young, but did not take up the study of iron and steel until 1852, at the age of 39. His first work in this field was in the improvement of cast iron for ordnance, from which he soon turned his attention to the pneumatic working of molten cast iron into steel. The record of his efforts in this his most important work is to be found in a paper, by Sir Henry, in the Transactions of the American Society of Mechanical Engineers, Vol. XVIII., page 455. That the process he invented and perfected is today used in the steel trade of Europe and America, producing 10,000,000 tons of steel annually, is a sufficient monument to his ability and usefulness.

Macaulay has said: "Of all inventions, the alphabet and printing press alone excepted, those inventions which abridge distance have done most for civilization." The cheapening of the steel rail has had an incalculable influence upon the distribution of mankind and of the necessities of life, and it is given to few men to improve the condition and surroundings of so many of his fellow men.

He has been honored by societies and by governments, the first distinction being the award of the Albert gold medal by the Prince of Wales in 1872, for "his eminent services to arts, manufactures and commerce in developing the manufacture of steel." His biography is contemporary with the history of the general use of steel and it will be best written when it can be better appreciated than is possible now. He lived at just the right time and was blessed with a clear appreciation of a necessity of vast importance and with the ability and perseverance to solve the difficult problem that presented itself to him.

He lived 85 years and was active in the development of his process until about ten years ago, when he began a life of retirement at his suburban home near London. He may be said to have completed his work, and it was a wonderfully large one.

BOOKS AND PAMPHLETS.

"De Pontibus, a Pocket-Book for Bridge Engineers," by J. A. L. Waddell, C. E., B. A., Sc., M. A. E.; First Edition, 12-mo., Morocco, 416 pages. Price $3. New York: John Wiley & Sons; London: Chapman & Hall, 1898.

The name of this book represents the character of the work. It means "Concerning Bridges," and is appropriate because there are no illustrations of details of construction, and because principles rather than examples of their application are presented. The work gives the practice of the author, and those parts which are not original represent what he has taken from the practice of others for use in his own work. The subject of stresses is not included, and the reader is referred to other standard works for such information. The book was written for the use of bridge engineers (and it will offer many suggestions to them), for young engineers in bridge manufacturing and designing offices, for professors of civil engineering, for students of civil engineering, for railroad engineers, to whom the specifications given will be valuable, and to the municipal and county officers who have to do with the placing of contracts for highway bridges.

In the introduction the author indicates the importance of

securing the services of an engineer specialist to design and watch the construction of bridges, and states that millions of dollars would have been saved in the construction of the New York and Brooklyn elevated railroads by giving attention to the first principles of design when the plans were made. In the second chapter, under "First Principles of Designing," the author offers many suggestions urging simplicity and directness, systemization of methods, the proper regard for rigidity as well as strength, the importance of architectural effect of structures, and gives many specific forms which he has found to be good practice. Many of these are simple and as old as the art of bridge building, while others are original with the author. It is a good idea to assemble them along with less generally understood principles that are not less important. It is not absolutely necessary to be told that "For members of any importance two rivets do not make an adequate connection," and that "Rivets should not be used in direct tension." There are many little things that may be criticised, but when it is considered that the book gives the practice of a successful engineer of very wide experience, these must be considered very valuable. The author gives considerable attention to "Aesthetics in Design," devoting a chapter to the subject.

The titles of other chapters are as follows: Cantilever bridges, arches, trestles and viaducts, elevated railroads, movable bridges, drawbridges, highway and combined bridges, details, general specifications, specifications for drawbridges, for highway draw spans, general specifications for manufacture, shipment and erection of steel bridges, trestles, viaducts and elevated railroads, compromise standard system of live loads for railway bridges, timber trestles, inspection of material and workmanship, designing of piers, triangulation and office practice. A large number of tables and diagrams worked out and used by the author are given, and the book is provided with a fair index. A great deal of ground is covered for so small a book, and much of it is new in the sense of not having been published in book form before.

This is a unique example of the records of practice from a man standing high in his profession, and while equally good authorities will not agree with the author in all the advice he gives, the book is a very valuable addition to the literature of bridges and metallic structures. The author's style is admirably clear and the book will be understood by readers with only elementary knowledge of the subject.

"Bibliographical Decimal Classification as Applied to Railway Science." By L. Weissenbruch, Principal Engineer Belgian State Railways, General Secretary of the Permanent Commission, Railway Congress. Brussels: P. Weissenbruck, publisher, 45 Rue du Poincon. Paper, 7x9½ in., 62 pages.

We have received a copy of this pamphlet, which, though occupying 61 pages, is a work of considerable magnitude and one that is sure to be appreciated by those who have found it necessary to the course of their professional work to classify and file information and documents having to do with railroads. This work was the result of the necessity for indexing the ten volumes of the Bulletin of the International Railway Congress, and to provide for the indexing of the regular publications of the Congress as they appear. Another reason for taking it up was in order to present an index to the principal articles that appear in the technical periodicals in different languages that are received at the headquarters of the Congress. Mr. Weissenbruch, after much study of the problem, decided to adopt the Dewey decimal system, which had previously been adopted by the International Institute of Bibliography, founded in 1885 under the patronage of the Belgian Government. This system was worked out and applied to the field covered by the Congress, and this pamphlet gives the classification and its index. The Dewey system is too well known to require explanation here, it being sufficient to say that the whole of human knowledge is divided into ten classes, and a number is given to each. The various subdivisions are indicated by whole numbers and decimals whereby any subject may be instantly located, and the filing and indexing of information be so simplified as to render it possible to turn this work over to a clerk, insuring its being done correctly. It is impossible for any one to arrange a system like this that is entirely free from objection, but the arrangement of this classification is such as to render its faults so small in comparison with its advantages as to make it worth while to send for the pamphlet and make an investigation of its merits. One of its most valuable features is that a monthly bibliography of current technical literature is furnished by the publisher of this pamphlet, and this includes the articles that appear in the Bulletin. The author's idea is that this classification and the publication each month of the bibliography of railroads in sheets or slips ready for cutting or pasting upon cards of card catalogue would render a large amount of periodical literature available for permanent record. He considers the decimal classification as an international language, and believes that this form of record will tend to help in the substitution of the magazine article for the book that is out of date the day of its publication.

"The Metallographist, a Quarterly Publication Devoted to the Study of Metals, with Special Reference to Their Physics and Microstructure, Their Industrial Treatment and Application." Edited by Albert Sauveur. Published by the Boston Testing Laboratories, 446 Tremont Street, Boston, Mass. Vol. I., No. 1.

This is the first appearance of a unique periodical, the scope of which is very well covered by the explanatory title. As stated in the introductory chapter, failures of metal structures, rails and axles are due, not to faults of the metals, but in some way they are to be traced to man and his methods of making or using the structures. The development of the present high state of the art of producing and working metals has been due to the work of a number of scientists and investigators, whose researches have been disseminated throughout the scientific papers and the transactions of scientific societies chiefly in France, England, Germany and the United States. The object of the "Metallographist" is to present, once in three months, a clear, exhaustive and comprehensive review of what has been accomplished in metallography during the previous quarter. Work done in the Boston Testing Laboratories will be published, and also original articles by eminent authorities, one of the principal objects being to render the publication valuable industrially. Mr. Sauveur is best known on account of his excellent work in connection with the microscopical examination of steel at the works of the Illinois Steel Company, in Chicago. We wish the new publication encouragement and success.

"Morison Suspension Furnaces for Internal Furnace Boilers."—The Continental Iron Works, New York, Borough of Brooklyn. This 36-page (9 by 11 in size) catalogue has just been issued by the Continental Iron Works to illustrate most recent practice in internal furnace tubular boilers. The opening chapter presents the advantages of the internally fired boiler over those set in brick work, which, on account of radiation and leakage, have been set aside by many progressive engineers in favor of the internally fired type. The boilers constructed by this firm, which are illustrated in the catalogue, contain relatively greater volumes of water than the other type and are designed with special reference to the ease of cleaning. The type of boiler presented here is a modification of the Scotch boiler, embodying the Morison Suspension Furnace. This type is compact, self-contained and consequently cheaper to build than those requiring brick settings. The catalogue describes the Morison Suspension Furnace manufactured in this country solely by this firm, giving a full size detail of the corrugation. It contains a page of notes and suggestions for designing this type of boiler, a form of specification, a large number of strong testimonials, excellent half-tone engravings of boilers now in use and an illustrated description of the Morison patent furnace front and door. Besides these, an important feature of the publication is a series of dimensioned drawings of seven boilers, ranging from 75 to 300 horse-power, with the riveting and the dimensions for four different pressures from 100 pounds up to 200 pounds per square inch. These designs are on sheets folded into the book and elevations of each size applicable to all the pressures are shown, together with scales of measurements and of the riveting. This is an admirable method of assisting purchasers to select a boiler that will meet their requirements and is thought to be new in boiler catalogues. We shall place this volume with the text books on steam boilers in our library, for while it is a catalogue of the best kind the information with regard to the dimensions and construction of boilers entitles it to a place among reference books.

The International Correspondence Schools of Scranton, Pa., have sent us a little pamphlet containing indorsements of the steam engineering courses by eighty-eight students from all parts of the country. The object of these schools is to provide a practical and thorough system of home instruction, without loss of time from work, for all persons interested or engaged in stationary, marine or locomotive steam engineering; for

those who have the care of dynamos and motors; for firemen, oilers, water tenders, coal passers, etc.; for those who wish to qualify themselves to fill positions or conduct business in any of these lines.

This pamphlet is intended to convey to these classes and to young people just starting out in life and about to choose their future occupations, an idea, from the letters of a few of its students in widely scattered parts of the globe, of the thorough and practical instruction which this school is prepared to give wherever written or printed matter can be sent. Those interested should send for a copy.

"Mining, Tunneling and Quarrying," Catalogue No. 41, The Ingersoll Sergeant Drill Co., 26 Cortlandt Street, New York.

This is a new and well-illustrated catalogue of the machinery manufactured by this firm and for which they are well and favorably known. Rock drills, quarry bars, gadders, stone channeling machines and air compressors are illustrated from photographs of machinery as set up for actual work. Besides the illustrations of quarry work a number of engravings are devoted to modern plant for submarine work, showing the drilling and charging. The submarine drilling plant used by P. Sanford Ross and others, and that used on Hay Lake Channel, Mich., by the Gilbert Blasting & Dredging Co., and also that employed for the removal of the iron gates of the Danube in Austria are shown. Detailed drawings of the drills are given with the parts numbered and named for ordering. Those engaged in rock work of any kind will find this catalogue valuable.

The Peerless Rubber Manufacturing Company of 16 Warren street, New York, have just issued a new edition of their catalogue of "Mechanical Rubber Goods." This edition is No. 26 and bears the date of March 1, 1898. Among the new features are specifications for rubber hose which are recommended by this concern and are guaranteed to be met by their goods. The requirements are so rigid as to cause inferior product to fail under it. It is not often that manufacturers issue difficult specifications for themselves to meet and this is a marked indication of the confidence of the concern in its own product. We described the process of manufacturing this hose in our issue of October, 1897, page 335. Another new feature of this catalogue is a description of the "Peerless Hose Nipple Cap," which we illustrated in our January issue of the current volume, page 26. We think the hose specification of sufficient inportance to publish in full, which is done in another column.

"Twenty-seventh Annual Report of the Railroad and Warehouse Commission of Illinois." Springfield, Ill., 1897.

This volume is received through the courtesy of Mr. Wm. L. Tarbet, Consulting Engineer of the Commission. It contains the usual statistical information, a detailed report by Mr. Tarbet as to the condition of the different railroads, in which many suggestive notes concerning improvements are made, the usual map showing the present use of interlocking at crossings and showing all of the railroad lines in the State is included, and also a number of excellent half tone engravings of interesting engineering features of recent railroad improvements in the State.

The "Q & C" Co. has distributed a new catalogue of car door equipment and general railroad specialties, including the following: Bryant portable rail saws, Bryant power sawing machines, Dunham car door equipment, Globe ventilators, McKee brake slack adjuster, N. R. S. protection strip, pressed steel brake shoe keys, pressed steel journal box lids, compound lever jacks, improved inside check valve, lower locking fixtures, metal housing cap, pneumatic cylinder cock controller, Priest snow flanger, self feeding rail drill, shop saws, trolley equipment, trolley separate parts, Williams locomotive valve setting device, and Williams portable stray bolt drilling machine. Copies will be sent upon application.

The Youngstown Bridge Co., of Youngstown, O., has printed a 48-page illustrated pamphlet, presenting a number of half tone engravings of railroad and highway bridges built by them and giving a large number of diagrams of weights of bridges for certain loads and spans and diagrams of reaction and moments, which will be useful to bridge designers. It also contains partial lists of railroad and highway bridges and concerns for whom building work has been done. This company has recently rebuilt its works and installed new machinery which will increase its capacity. It will be remembered that after being in operation for ten years the plant was burned down last September.

"Mother's Magazine."—A year ago the National Congress of Mothers was started in Washington, D. C., and at once developed into a great national movement, having for its objects the establishment of Mothers' Clubs throughout the country, and the consideration of all matters pertaining to childhood and motherhood, and of the knowledge that science teaches concerning the care of the young and the formation of character. We have just received a copy of the very handsome and interesting "Mother's Magazine," designed to work along the same lines as the Congress of Mothers, and to disseminate, in an attractive form and interesting way the most valuable and instructive information of use to mothers. The magazine is published in New York, by Mr. George H. Baker, and the March number contains 140 pages of handsomely illustrated articles.

"The Birth of Ocqueoc." A legend of the Presque Isle country, Michigan, and other tales, profusely illustrated from photographs taken in the various localities. Not by J. Fennimore Cooper.

This is one of the best illustrated and one of the most attractive pamphlets ever gotten up by a railroad to exhibit the attractions of the farming country and the hunting and fishing resorts along its lines. The engravings are so handsome as to lead to the preservation of the pamphlet, and that is a good deal to say of anything of this kind nowadays. It is devoted to the country reached by the Detroit & Mackinac Railway. Mr. J. D. Hawks, President and General Manager, office at Detroit, will send copies upon application, accompanied by ten cents postage.

The Railway News Bureau of Chicago has printed in a pamphlet the full text of the five bills now before Congress referring to railroads. They are the "Foraker Bill," the "Chicago Bill," the two anti-scalping bills and the "Cullom Bill." The bills in this convenient form will be sought for by many railroad men. The price is 25 cents for single copies and $1 for five copies.

The Railroad Officials' Diary, 1898, is a standard-size book, with a page for each day of the year, each page being headed with the date printed in bold type. The paper is good, and also the binding, which is of flexible leather. The diary is sent with the compliments of the Railroad Car Journal, 132 Nassau street, New York.

"Massachusetts Institute of Technology. Annual Catalogue 1897-1898. A statement of the Courses of Instruction and a Register of the Alumni; Thirty-third Annual Catalogue of the Officers and Students." Boston, 1898.

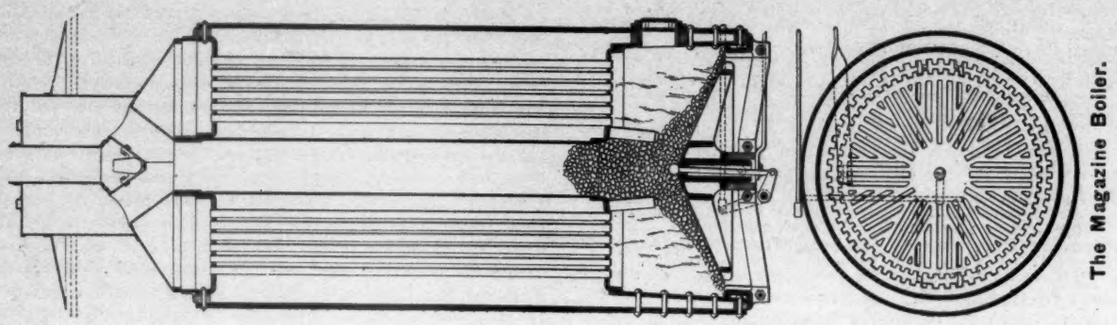
"Proceedings of the Seventh Annual Convention of the Association of Railway Superintendents of Bridges and Buildings, Held in Denver, Col., October, 1897." Edited by the Secretary, Mr. S. F. Patterson, Concord, N. H.

MR. A. M. WAITT AT PURDUE.

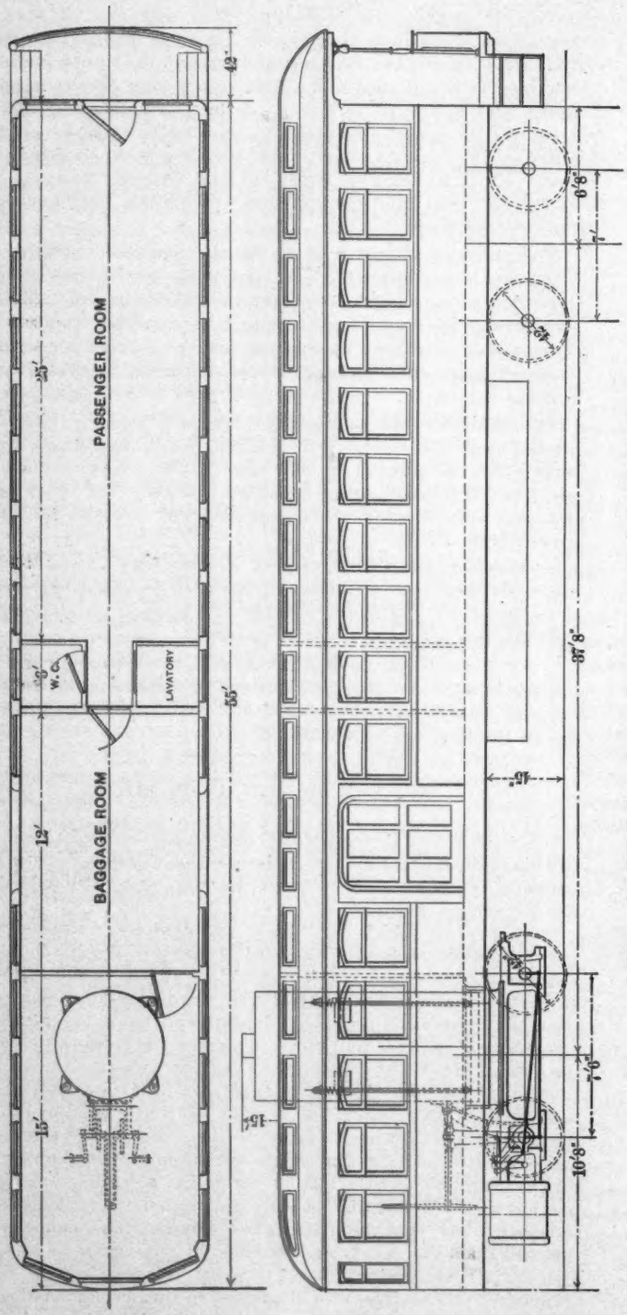
Mr. A. M Waitt, General Master Car Builder of the Lake Shore & Michigan Southern Railway, delivered the eleventh lecture in the course of railway addresses before the engineering students at Purdue University March 17.

The course in which Mr. Waitt appeared was arranged with a view of presenting to the advanced students of Purdue the significance of the important problems making up the organization of a railway company. The general plan is to continue from year to year, the expectation being that departments having no representative in any given year will be given a place in the work of succeeding years. Mr. Waitt, representing the car department, called attention to the fact that more than a million cars enter into the equipment of American railways. He described the many different purposes which they are designed to serve, and called attention to the difficulties to be met in maintaining them in good order. The important problems to be met in car design were discussed in connection with a description of the construction of a typical box car. It is safe to say that the students to whom he spoke had never before imagined the variety and number of conditions to be considered in the construction of what to many may seem a rather simple structure. The address was illustrated by means of colored charts which served well to demonstrate the principal points developed.

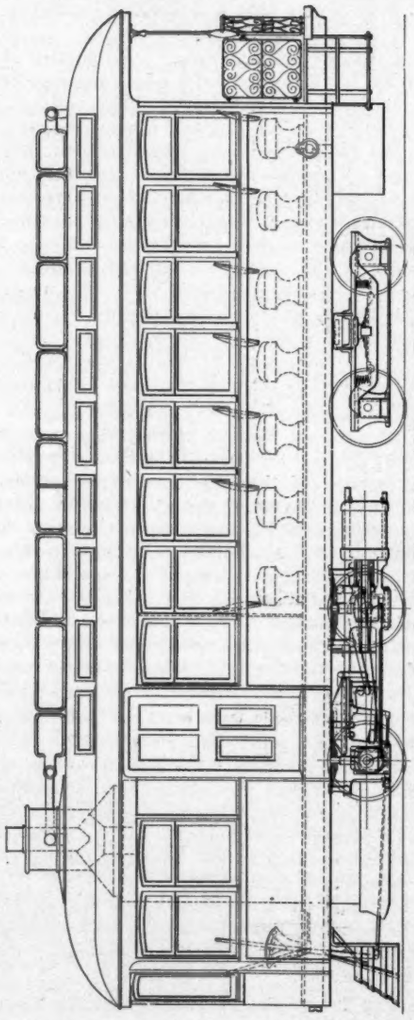
The next and last lecture of the course will be given by Dr. Charles B. Dudley, of Altoona, who will represent the chemical department of railways.



The Magazine Boiler.



Plan and Elevetion of Car for the Detroit & Lima Northern.



Car for the Cincinnati, Hamilton & Dayton Traction Co.

STEAM MOTOR CARS BY THE BALDWIN LOCOMOTIVE WORKS.

STEAM MOTOR CARS BY THE BALDWIN LOCOMOTIVE WORKS.

The Baldwin Locomotive Works have recently completed two steam motor cars, one was built for the Cincinnati, Hamilton & Dayton Traction Co., and is intended for use on the tracks of the C., H. & D. R. R., while the other is for the Detroit & Lima Northern Railway. Both cars are intended to be handled by two men only and the arrangements for the feeding of fuel are made with special reference to this plan. Both locomotives are the Vauclain compound type and both boilers are self-feeding.

The engravings give a good idea of the construction and the arrangement of the boilers and machinery. The C., H. & D. car is much smaller than the other and the boiler is carried upon the floor of the car body, connection being made to the cylinders through flexible metallic joints of the Moran pattern. The valve motion is attached in the ordinary way to the truck, and is placed between the two driving axles. In trials this car has been run for 38 miles without attention to the fire, and a speed of 42½ miles per hour has been maintained for a distance of 17 miles. The condenser placed upon the roof is not intended for continuous use, but is sufficient to completely condense the steam of the exhaust while running for several miles through towns or thickly settled parts of the line. Whenever practicable, the exhaust is turned directly into the air. The condensation from the exhaust is returned to the tank underneath the car.

The condenser is made of very thin, No. 22, brass tubes 1½ inches in diameter, of which there are 360, so arranged by connections with cast-iron headers that the exhaust passes through the entire length of the radiating surface, and it is sure to be condensed before reaching the end, so that there is no visible or audible exhaust while the condenser is in use.

The boiler, upon which an application for a patent has been made, is of the upright, fire-tubular type, with a ten inch magazine for feeding the grate with coal. The grate is circular and is shaken from the operating compartment by a lever. As shown in the section of the boiler, a rod passes up through the center of the grate and terminates in a ball. By moving this rod up and down by means of a lever, the coal from the magazine may be fed down over the grates as required. A fire door is provided for use if necessary; it is placed beneath the floor, and is reached through a trap in the floor of the car.

Twelve short water tubes project downward into the firebox in such a way as to form a cage to confine the stream of coal from the magazine, and cause it to spread out over the grate. These are two inches in diameter, and into each one a thin sheet-iron circulating tube is dropped from the top end. The heat from the fire causes water to pass upward on the outside of the circulating tubes and downward on the inside. The thin sheet merely forms a partition for this purpose.

These are some of the chief dimensions of the equipment:

Fuel, anthracite coal or coke. Weight in working order, not including passengers, about 48,000 pounds, with about 32,000 pounds on the driving wheels. Cylinders of Vauclain compound type, high pressure 5½ inches in diameter, low pressure 9 inches in diameter, stroke 12 inches. Driving wheels, 30 inches in outside diameter. Total wheel base, 16 feet 8 inches. Driving wheel base, 5 feet, 0 inch. Driving axles of steel, with journals, 5 by 6 inches. Driving boxes of brass. Boiler, 48 inches in diameter, centrally fired, self-feeding type, being supplied with coal from the top of the car roof around the stack through a 10 inch pipe in the center of the boiler. Boiler of steel ½ inch thick, and carries a working pressure of 180 pounds to the square inch. Tubes of iron, 304 in number, 1¼ inches in diameter and 5 feet long. Fire box 42⅝ inches in diameter, and 22 inches deep.

The frames supporting the cylinders and driving mechanism are embodied in a swivelling truck which forms a support for the forward end of the car. A four-wheeled swivelling truck acting simply as a carrier is placed under the rear end of the car and is provided with wheels 30 inches in diameter and axle journals 3½ by 7 inches. The car body is 32 feet 9 inches over all, with clerestory, and is divided into passenger, baggage and engineer's compartments. The passenger compartment, which has a seating capacity for 24 persons, is finished in quartered oak, and is provided with transverse seats with an aisle in the center. The passenger compartment is heated by steam and well lighted. All trimmings are of bronze metal. A toilet room is located at one end of this compartment. The baggage compartment is about 6 feet in length and located between the engine room and passenger compartment, with both of which it communicates.

Two tanks, each with a capacity of 150 gallons, are placed under the car body, from one of which the feed water is taken while the other, being connected with the condenser, receives the water formed by the condensing steam, but both these tanks are connected and supply the feed water to the boiler.

The chief feature of the car for the Detroit & Lima Northern Ry., which is much larger than the other, are the methods of suspension of the front end of the car, and the arrangement of the valve motion. The boiler is the same as the other, but larger, and it is carried directly upon the truck. The boiler turns within the car without requiring jointed steam connections. There is no condenser in this equipment. The cylinders are compounded on the Vauclain system, and they are 9½ and 16 by 18 inches in size. The boiler is 60 inches in diameter, with 630 square feet of heating surface. It will run 40 miles without attention to the fire and is calculated to make a speed of 40 miles per hour on a level or easy grade, while hauling two or three cars. This is a powerful engine and it is practically a light suburban locomotive combined with a car. The valve motion is inside the car. The eccentric rods are vertical, connecting to the links, which are horizontal and removed from the dust. The valves take their motion from a bell crank connection. This arrangement is patented.

The suspension of the weight of the car is new, a patent having been applied for by Mr. W. L. Austin. The object sought was a free and easy spring hanging, which should not depend upon the trucks for the cushioning. In this case the weight of the car is carried by four rods to lugs secured to the sides of the boiler. These rods transmit the load through long coil springs with spherical seats, and the motion is said to be very satisfactory. The boiler, as already explained, is mounted on the truck with a large guiding casting for the car.

There can be no doubt of the value of these light motors operated by only two men, and it will not be at all surprising to see a large number of them in use on suburban and branch lines in the near future.

FIRES IN NAVAL VESSELS.

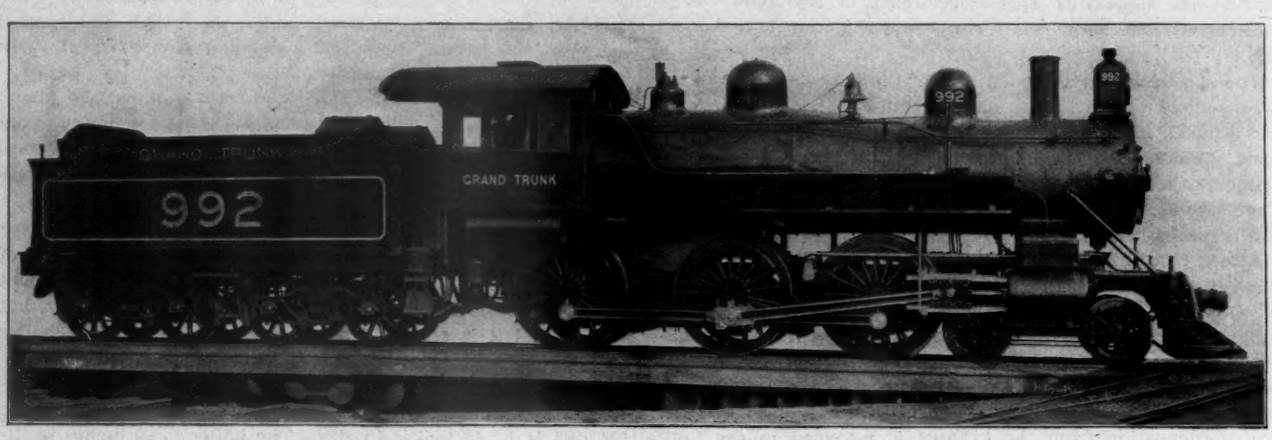
A statement prepared by the Board of Naval Officers recently appointed to investigate the subject of spontaneous ignition of coal, summarizes the supposed causes of combustion in eleven out of twenty fires reported on war vessels in the past three years. The Petrel's upper bunker caught fire two years ago at a point 18 inches from the boiler, presumably from the great heat, 200 degrees, in the space between boilers and bunker and to the absence of ventilation, as the ship had been battened down for a week. According to the New York "Sun," the report says that wet comax coal had been stowed in this bunker repeatedly without any trouble as long as there was some exit for gas.

A fire in the lower bunker of the Olympia was believed to be due to proximity of the boilers and feed tank. The back head of the boiler was about 8 inches from the bunker, but the feed tank adjoined it. Another fire later on the same ship was reported to be due to the proximity of the upper bunkers to the steam pipes and boilers. A fire on the Cincinnati was due to bad bunker ventilation. The heat in this instance was so great that it charred the wood around the shellroom in adjacent magazine, which was separated from the bunker by a single bulkhead only.

Fire in the Indiana's bunkers was due to the location of the bins, which were so placed that anything short of anthracite might ignite. A fire on the Albatross became so intense that redhot coals nearly burned the floor of the bunkers through. In a number of other instances fire occurred, but practically all the investigations showed that the coal had ignited through proximity of the bunkers to the fireroom or steam boilers or pipes.

NEW STANDARD LOCOMOTIVES—GRAND TRUNK RAILWAY.

An unusual plan was recently adopted by the Grand Trunk Railway in ordering new locomotives. This was a combination of the ideas of Mr. F. W. Morse, Superintendent of Motive Power of the road, with those of the Baldwin and the Schenectady people. The order was divided between the builders, the Baldwin people building four ten-wheel passenger and six mogul freight engines, while the Schenectady people are building an equal number of each. Our illustrations show the ten-wheel design with the principal dimensions.



New Standard Ten-Wheel Passenger Locomotive—Grand Trunk Railway.

The parts as far as possible have been made interchangeable between the two types. How far this has been carried out is apparent in the table of dimensions given below. The boilers are alike, except that the one for the ten-wheel class is 37 inches longer in the first barrel sheet than the other. The fireboxes are 10 feet long. The boiler pressure is 200 pounds. The passenger engines are 14,500 pounds heavier than the freight, but they have 3,000 pounds less weight on the drivers than the others. The heating surface of the passenger engines is 2,461 square feet, as compared with 1,991 square feet for the freight engine, while the grates and fireboxes are the same in both types. The driving axles are all alike, 9½ by 12 inches, which we believe to be the largest ever used in locomotives.

The engines by the Baldwin Locomotive Works are finished and in service, rapid progress having been made on the others by the Schenectady Locomotive Works, which were started later. These engines should be well designed, as very few are the subject of study by the officers of a railroad and two prominent building firms. The object was to secure the best practice as employed in a number of recent designs, and to profit by satisfactory combinations rather than by radical departures from good precedents. We cannot neglect this opportunity to strongly commend this plan of interchangeability. It should be done as often as possible.

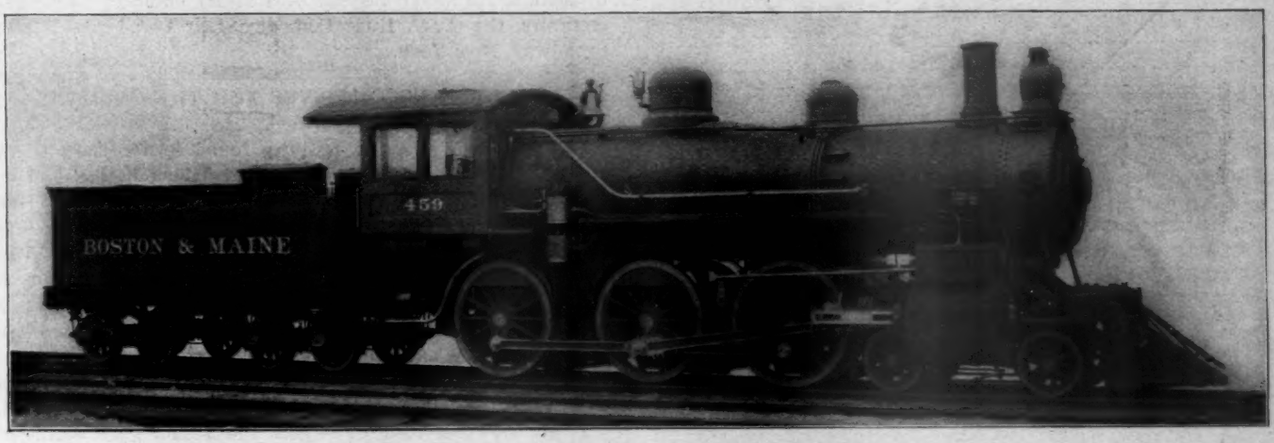
The special equipment for the Baldwin engines is briefly noted as follows: Main drivers cast steel, front and back drivers cast iron; steel centers for 10-wheel engines, by the American Steel Casting Co.; steel centers for the moguls, by the Standard Steel Works; axles, engine trucks, springs and bell ringers, by the Baldwin Locomotive Works. The following equipment is the same for both types: Sight feed lubricators by the Detroit Lubricator Co.; front and back M. C. B. coupler and driver brakeshoes by the Grand Trunk Railway; safety valve and mufflers by the Coale Muffler & Safety Valve Co.; air pumps, governors and tender brake equipment by the Westinghouse Air-Brake Co. The driver brake equipment is American. The engines have the Houston sanding device, Sterlingworth tender brakebeams, American tender brakeshoes, Crosby steam gages, United States metallic packing and Adams & Westlake headlights. The lagging of the boilers is wood with asbestos paper above and below. The chief dimensions are as follows:

	Ten-wheel Pass.	Mogul.
Builder's class and number	10.34 D, 326 to 329	8.34 D, 15 to 20
Number	992 to 995	901 to 906
Gage	4 ft. 8½ in.	4 ft. 8½ in.
Kind of fuel to be used	*Bituminous coal.	
Weight on drivers, lbs.	117,000	120,000
" truck wheels "	37,500	20,000
" total "	154,500	140,000
Wheel base, total, of engine	26 ft. 11 in.	24 ft. 1 in.
" driving	15 ft. 8 in.	15 ft. 8 in.
" total, engine and tender	53 ft. 9 in.	50 ft. 11 in.
Length over all, engine	42 ft. 8 in.	39 ft. 10 in.
" total engine and tender	64 ft. 11 in.	62 ft. 1 in.
Height, center of boiler above rail	8 ft. 9½ in.	8 ft. 4½ in.
Height of stack above rail	14 ft. 7½ in.	14 ft. 2½ in.
Heating surface, firebox, sq. ft.	189	188.1
" tubes "	2,272	1,803
" total "	2,461	1,991.1
Grate area "	33.43	33.43
Wheels and Journals.		
Diameter of driving wheels	72 in.	62 in.
Truck wheels, dia.	37 in.	37 in.
Journals, driving axle, size	9½ in.×12 in.	9½ in.×12 in.
" truck "	6½ in.×10½ in.	6½ in.×10½ in.
Main crank pin "	6½ in.×6 in.	6½ in.×6 in.
Parallel rod pin "	5½ in.×4 in.	5½ in.×4 in.
Crosshead pin "	4 in.×3½ in.	4 in.×3½ in.
Cylinders.		
Cylinder diameter	20 in.	20 in.
Piston stroke	26 in.	26 in.
" rod diam.	3¾ in.	3¾ in.
Main rod, length cen. to cen.	10 ft. 8¼ in.	7 ft. 7¼ in.
Steam ports, length	20 in.	20 in.
" " width	1⅝ in.	1⅝ in.
Exhaust ports, length	20 in.	20 in.
" " width	3 in.	3 in.
Bridge, width	1⅜ in.	1⅜ in.
Valves, kind of	*Balanced.	
" greatest travel	5½ in.	5½ in.
" outside lap	⅞ in.	⅞
" inside lap	0	0
" lead in full gear	⅛ in.	⅛ in.
Boilers.		
Boiler, type of	*Extended wagon top.	
" working steam pressure	200 lbs.	200 lbs.
" material of barrel	*Steel.	
" thickness of material in barrel	21-32	21-32
" diam. of barrel at front sheet	62 in.	62 in.
" " circumferential	*Double riveted.	
Thickness of tube sheets	¾ in. front, ½ in. back.	¾ front, ½ back
" crown sheet	⅜ in.	⅜ in.
Crown stayed with	*Radial stays.	
Dome, diameter	31½ in.	31½ in.
Tubes, number	291	291
" material	*Lap welded iron.	
" outside diameter	2 in.	2 in.
" length over tube sheets	15 ft.	11 ft. 11 in.
Firebox, length	120 in.	120 in.
" width	40⅛ in.	40⅛ in.
" depth	76¾ f. 65 b.	73¾ f. 65 b.
" material	*Steel.	
" thickness of sheets	Crown, ⅜ in. Tube, ½ in. Sides, 5-16 in. Back, ⅜ in.	Crown, ⅜ in. Tube, ½ in. Sides, 5-16 in. Back, ⅜ in.
" Brick arch	*Yes.	
" water space, with frnt	4 in.	4 in.
" " " sides	3½ in.	3½ in.
" " " back	4 in.	4 in.
Smokebox, diameter	65½ in.	65½ in.
" length from tube sheet to end	5 ft. 10 in.	5 ft. 10 in.
Other Parts.		
Exhaust nozzle	*Fixed, single.	
" " thimbles	5 in., 5¼ in. and 5½ in.	5 in., 5¼ in. and 5½ in.
" " distance of tip above cen. of boiler	6½ in.	6½ in.
Smokestack (straight), diam.	15¾ in.	15¾ in.
" height above smoke box	37 in.	37 in.
Tender.		
Type	8-wheel	8-wheel
Tank capacity for water	4,500	4,500
Coal capacity	10 tons	10 tons

* These items are the same for both classes of engines.

TEN WHEEL LOCOMOTIVE—BOSTON & MAINE R. R.

Sixteen ten wheel freight locomotives have recently been ordered by the Boston & Maine Railroad; six are single expansion type, with 19 by 26-inch cylinders and 36-inch driving wheels, and were ordered from the Manchester Locomotive Works at Manchester, New Hampshire, while the others are two cylinder compounds ordered from the Schenectady Locomotive Works. Both types are from drawings and specifications prepared by the motive power department of the road. The compounds, one of which is illustrated, are to be used on the Concord and White Mountains divisions, both of which are hilly. Four of these have already been delivered and are now entering service, giving promise of very satisfactory results.



Schenectady Ten-Wheel Compounds—Boston & Maine R. R.

These engines are equipped with two three-inch Ashton safety valves, one Siebert and one Nathan sight feed lubricator, American outside equalized brake on all drivers, Westinghouse air brake on tender and for train, magnesia sectional boiler lagging, National hollow brake beams, Standard truck wheels and Leach sanders. The chief dimensions of the compounds are given below, and as the simple engines are similar, one description answers for both types:

General Dimensions.

Gauge	4 feet 8½ inches
Fuel	Bituminous coal
Weight in working order	141,000 pounds
" on drivers	103,000 pounds
Wheel base, driving	14 feet
" " rigid	14 feet
" " total	24 feet 5 inches

Cylinders.

Diameter of cylinders	high pressure, 21 inches; low pressure, 32 inches
Stroke of piston	26 inches
Horizontal thickness of piston	5¾ inches and 4¾ inches
Diameter of piston rod	3½ inches
Size of steam ports	H. P., 20x2½ inches; L. P., 23x2½ inches
" " exhaust "	H. P., 20x3 inches; L. P., 23x3 inches
" " bridges "	1⅝ inches

Valves.

Kind of slide valves	Allen-Richardson, balanced
Greatest travel of slide valves	6 inches
Outside lap " " "	H. P., 1¼ inches; L. P., 1⅛ inches
Inside lap " " "	¼ inch clearance
Lead of valves in full gear	—

Wheels, Etc.

Diameter of driving wheels outside of tire	63 inches
Material of driving wheels, centers	Main, cast steel, F. & B. steeled cast iron
Driving box material	Gun iron
Diameter and length of driving journals	8 inches diameter by 10 inches
" " " " main crank pin journals	Main side, 6¼x5½ inches; main, 5½ inches diameter by 6 inches
" " " " side rod crank pin journals	F. & B. 4½ inches diameter by 4 inches
Engine truck, kind	4-wheel, swing bolster
" " journals	5½ inches diameter by 10 inches
Diameter of engine truck wheels	30 inches
Kind " " " "	Standard, O. H. steel tired, spoke center

Boiler.

Style	Extended wagon top
Outside diameter of first ring	58 inches
Working pressure	200 pounds
Thickness of plates in barrel and outside of firebox	9-16, ⅝, 11-16 and ½ inch
Horizontal seams	Butt joint, sextuple riveted, with welt strip inside and outside
Firebox, length	96 inches
" width	42⅛ inches
" depth	F, 70 inches; B, 61 inches
" plates, thickness, sides, ⅜ in.; back, ⅜ in.; crown, ⅜ in.; tube sheet, ½ in.	
" water space	4 in., front; 3½ in., sides; 3 in., back
Tubes, number of	267
" diameter	2 inches
" length over tube sheets	13 feet 4 inches
Heating surface, tubes	1,852.33 square feet
" " firebox	141.4 square feet
" " total	1,993.73 square feet
Grate "	27.39 square feet
Smoke stack, inside diameter	15⅝ inches
" " top above rail	13 feet 9 inches
Boiler supplied by 2 Hancock type "B" improved inspirators,	size No. 8

Tender.

Weight, empty	34,000 pounds
Wheels, number of	8
" diameter	33 inches
Journals, diameter and length	4½ inches diameter by 8 inches
Wheel base	15 feet 8 inches
Tender frame	8-inch steel channel
Water capacity	4,000 U. S. gallons
Coal "	8 tons
Total wheel base of engine and tender	49 feet 11¼ inches
" length " " " "	59 feet 4½ inches

THE HUNT COAL CRACKER.

The Hunt coal cracker is designed for breaking the large lumps in run of mine of bituminous coal into smaller pieces that will feed through the automatic stokers used under the boilers of large steam generating plants. It is believed by

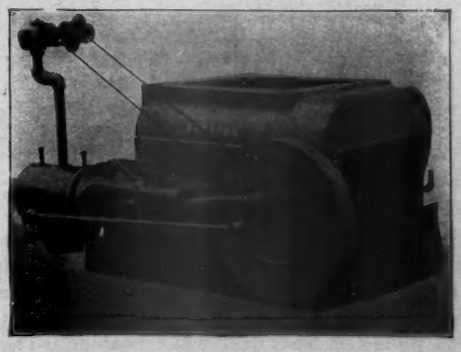


Fig. 1.

many engineers who use hand firing, both in stationary and in locomotive boilers, that it is advantageous to break the larger lumps of coal into smaller sizes, both on account of the easier and more perfect distribution of the coal on the

grates by the fireman and a more perfect combustion resulting from an evener fire. The points on the rolls are made of tool steel with hardened ends, especially designed to crack and not to crush the lumps of coal so that none of the advantages of lump coal are lost. The fine coal passes through the rolls unaltered.

The cuts show the cracker driven by a direct connected steam engine having the steam ports and passages all draining continuously downward, the steam entering at the top of the cylinder and the exhaust passing out at the bottom, so that all condensed seam is immediately drained off, and every drop of the water from cylinder condensation is swept out of the cylinder and ports at each stroke of the piston.

The cross-head bearing on the slide is made longer than the stroke of the piston so that it will not uncover a central

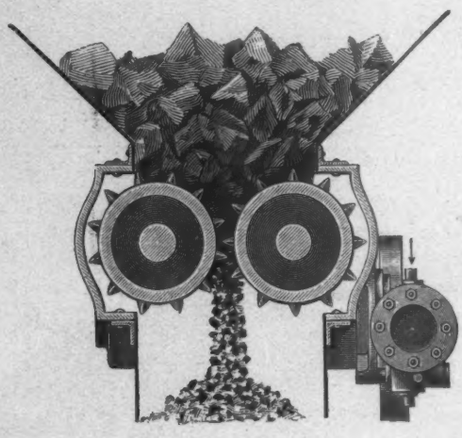


Fig. 2.

oil well, packed with an elastic absorbent packing, that keeps the sliding surface constantly swabbed with oil. The bearing is unusually wide, so that the bearing on the slide is about four times the area generally used.

The rolls are made the proper diameter to break the coal to the size required, and are not adjustable in the frame, thus eliminating all elements that might be sources of weakness and delay. Both the gearing and the rolls are entirely inclosed, each in a separate compartment in a cast iron frame. This prevents the coal dust from entering either the bearings of the machinery, the gear box, or the room in which the breaker is located. The gearing is easily accessible, but entirely inclosed and protected from dust while running. The gearing runs in a bath of oil that insures perfect lubrication. The vertical distance between the feeding hopper and the delivery spout is reduced to a minimum as the space available for the cracker is usually limited. A horizontal spindle governor is adjusted in position and so located as not to interfere with the feeding hopper. The breaker may be placed below the hopper under the railway car track so that the coal feeds directly from the car through the rolls into a conveyor which transports it to the storage bins. When coal is hoisted from a vessel the breaker is usually put under the hopper, into which the coal buckets dump.

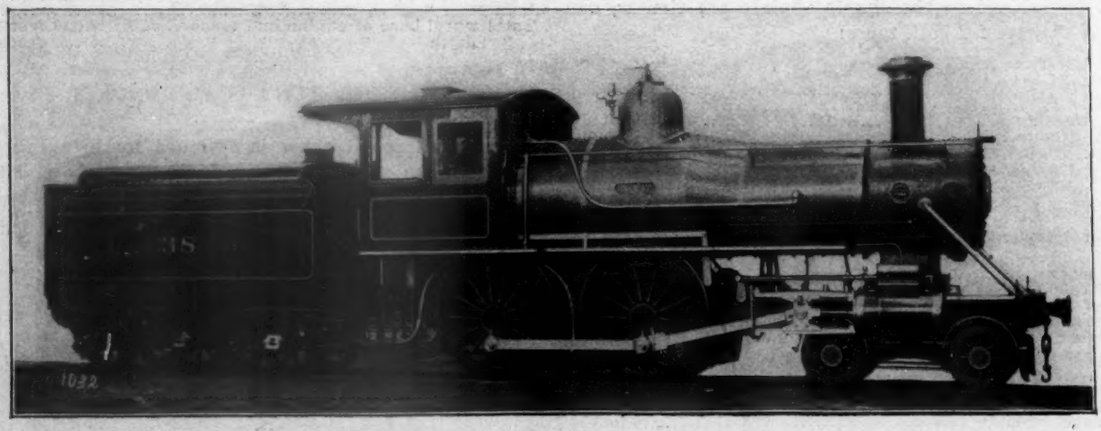
While the average horse-power consumed by a coal breaker is small, the necessity for strong and perfect construction of the parts under stress must be evident. The axles in the rolls are of steel, large in diameter, and the frame is of massive construction to resist the great and sudden strains that may come upon it, especially when some hard substance accidentally falls in the rolls while running.

These machines can be used to advantage for breaking other hard substances, the rolls in such cases being made to suit the work. They may also be operated fro mordinary shafting or by an electric motor instead of a steam engine. The manufacturers, the C. W. Hunt Company, may be addressed at 45 Broadway, New York.

BALDWIN LOCOMOTIVES FOR THE SOUDAN.

The British War Office recently found it necessary to obtain four locomotives upon exceedingly short notice, and not being able to get them from any English builders in time, the order was placed with the Baldwin Locomotive Works, and the photograph shows one of the completed engines. They were ordered by the Consulting Engineer in London for the Soudan Railroad, the order being received in Philadelphia Jan. 6, under agreement to ship the four engines by March 6. An emergency arose and the builders were requested to anticipate the date of delivery, and after the work was started it was accelerated, and shipment made from the works Feb. 9. The engines were received on board the steamship "Stalheim" Feb. 11. Under the terms of the contract the builders have sent a representative to attend to the unloading at Alexandria, the re-loading upon cars and shipment to the Soudan, and the erection and trial for service at their destination.

The general dimensions are: Cylinders, 15x24 inches; weight in working order, 35 tons; driving wheels, 60 inches in diameter; gage of track, 3 feet 6 inches; fuel, petroleum or bituminous coal; boilers, steel; firebox, copper; tubes, brass. The



Baldwin Locomotives for the Soudan.

engines have six-wheel tenders, four of which wheels are in a truck, while the others are in pedestals.

The engines have grates for burning bituminous coal and also tanks and oil injectors for burning petroleum. The details were specially arranged to meet the peculiar conditions of service in the Soudan. They are the first locomotives ever built in this country for Egypt, and the promptness of the Baldwins must be considered wonderful under the circumstances. The rapid work speaks volumes for the equipment and management of the works.

THE COFFIN TOUGHENING PROCESS.

This process of treatment of steel, which has for a number of years been used in the manufacture of axles, crank pins and piston rods for locomotives, was described in detail by the aid of etchings and diagrams in a paper by Mr. L. R. Pomeroy, at the February meeting of the Western Railway Club. The paper shows a careful study of the effects of the heat treatment of steel, the advantages of the Coffin process briefly stated being that the irregularities produced by forging are relieved and the steel brought from an irregular and coarsely crystalline to an amorphous condition, also the elastic limit of the steel is greatly increased without loss of elongation or ductility. The change of the structure was admirably shown in the paper by a number of remarkably clear etchings and the effect upon the elastic limit was exhibited by the following figures for an axle which was cut in two and one-half toughened by the Coffin process, while the other was tested in its natural state:

	Elastic Limit Lbs.	Ultimate Strength Lbs.	Elongation Per. Cent.	Reduction Per. Cent.
Untoughened	30,000	71,520	24.50	51.50
Toughened	44,000	72,020	24.07	57.20

During the early days of the use of steel laboratory conclusions had shown that steel was superior to iron and it was taken up by manufacturers for railway purposes, but difficulties were soon found in the form of mysterious breakages which are now known to have been caused by the forging stresses which this process was designed to remove, the process having now been used successfully for eight or ten years. The conditions as regards forging stresses are stated in the paper as follows:

In our judgment, the real reason for the prejudice against steel, and for the alleged mysterious fractures occasionally noted, is due to the unequal strains set up in the material caused by unequal heating and working. In the process of forging we are putting work upon the piece, and, if this is so, no two blows are given under the same conditions. The metal is cooling slightly between each blow, so that it can be safely said no two parts have been worked alike, and the material in this form has forging strains in it. In other words, there is a different condition for every inch of length of the forging, consequently we maintain that there is just as much a necessity for relieving these forging strains as there is for relieving the strains in a complicatedly flanged throat sheet of a boiler by annealing. That is to say, the throat sheet, after flanging, and the specimen after forging, does not fairly represent the initial and intrinsic value of the steel.

The author presented a number of diagrams tending to show the effect of annealing and oil hardening upon a tensile strength an elongation of steels having from 0.28 to 1.5 carbons as compared with normal steel. These plainly indicate that oil hardening raises the tensile strength of the corresponding decrease in the elongation while annealing reduces the tensile strengthwith a slight increase in the elongation. The author believed that the following conclusion was warranted by his investigations:

That as the elastic limit is the factor that is taken into consideration in designing structures, such as axles or crank pins, the elastic limit being the point on which the bending stresses are based and calculated, any form of subsequent treatment which increases the elastic limit at the expense of raising the ultimate strength is an illegitimate method of arriving at the ideal results, because with mechanical working the elastic limit will follow the ultimate strength through the various manipulations; this point is very strongly brought out in the tests cited. We have here two tests of the Coffin process—one .42 carbon and the other .36 carbon; the tensile strength of the .42 carbon was increased 2 per cent., while the elastic limit was increased 36 per cent. On the .36 carbon the tensile strength was increased only .007 per cent., while the elastic limit was increased 46 per cent. This clearly indicates that we have obtained the increase in elastic limit, not at the expense of raising the ultimate strength, but in a legitimate way.

BROOKS LOCOMOTIVES FOR KOREA.

Last month the fact that the Brooks Locomotive Works had received the order for four locomotives for the Seoul-Chemulpo Railway in Korea was noted, these locomotives have been completed and one of them is illustrated by the accompanying cut.

Last year an American firm secured from the Royal Government of Korea a concession to build a railroad, the first and only one in that country, and notwithstanding constant political disturbances its construction and equipment have gone steadily forward. This railroad is of the American standard gauge (4 feet 8½ inches) and is known as the Seoul-Chemulpo Railway extending from Seoul, the capital of Korea, on the north to Chemulpo, the chief seaport on the south, a distance of about 25 miles.

Brooks Locomotives for Korea.

The engines are single expansion, side tank, mogul type, built to standard gauge and for burning bituminous coal. The maximum total weight is 78,600 pounds, of which 67,600 pounds are on the drivers and 11,000 pounds on the truck. The capacity of the feed water tank is 960 gallons and of the coal space one ton.

General Dimensions.

Wheel base, total, of engine	19 feet 0 inches
" " driving	12 feet 3 inches
Length over all, engine	30 feet 1 inch
Height, center of boiler above rails	6 feet 2 inches
" stack above rails	11 feet 2⅛ inches
Heating surface, firebox	71.2 square feet
" " tubes	575 "
" " total	646.2 "
Grate area	12.66 "

Wheels and Journals.

Drivers, diameter	42 inches
" materials of centers	Cast iron
Truck wheels, diameter	28 inches
Journals, driving axle, size	6 by 7½ inches
" truck " "	4¼ by 8 inches
Main crank pin, size	3¾ by 4 inches

Cylinders.

Cylinders	14 by 22 inches
Piston rod, diameter	2⅝ inches
Main rod, length, center to center	68½ inches
Steam ports, length	12 by 1¼ inches
Exhaust ports, length	12 by 2½ inches
Bridge, width	1⅝ inches

Valves.

Valves, kind of	Richardson
" greatest travel	6¼ inches
" outside lap	⅞ inch
" inside "	3-32 inch

Boiler.

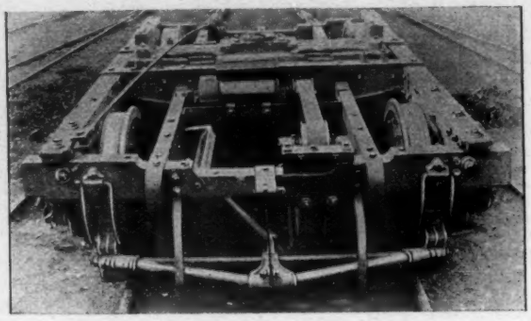
Boiler, type of	Straight top
" working steam pressure	140 pounds
" material in barrel	Steel
" thickness of material in barrel	⅜ inch
" " " " tube sheet	½ inch
" diameter of barrel	46 inches
Seams, kind of horizontal	Quadruple
" " " circumferential	Double
Crown sheet stayed with	Radial stays
Dome, diameter	22 inches

Firebox.

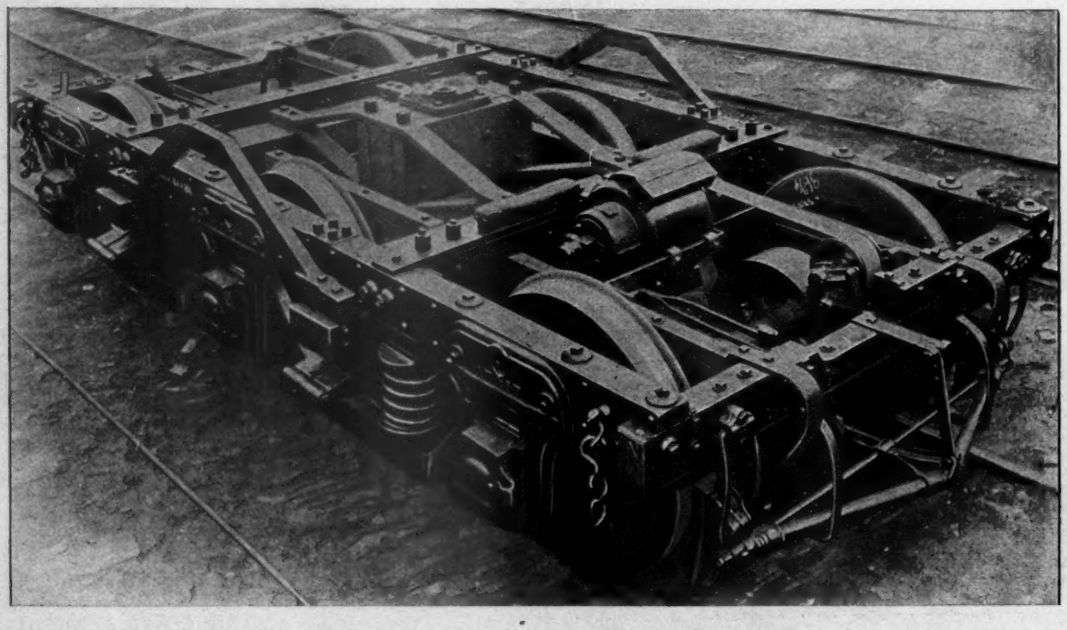
Firebox, type	Deep
" length	54 inches
" width	35 "
" depth, front	58½ "
" " back	58½ "
" material	Steel
" thickness of sheets	Sides and crown, ⅜ inch
	Back 5-16 "
	Tube ½ "
" Brick arch	On studs
" mud ring, width	Front, 3½ inches
	Sides, 3 "
	Back, 3 "
" water space at top	Front, 3½ inches
	Sides, 4 "
	Back, 4 "
Grate, kind of	Rocking
Tubes, number	122
" outside diameter	2 inches
" thickness	No. 13 B. W. G.
" length	9 feet 1 inch

AXLE LIGHTING ON THE SANTA FE.

The engravings show the application of the apparatus of the National Electric Car Lighting Company to a 4-wheel and a 6-wheel truck on the Atchison, Topeka & Santa Fe Railway, representing the equipment of 54 cars now running with this light on that road. The arrangement of the generators is similar except that the 4-wheel truck brings the machine into closer quarters than the other. We have described the apparatus of this company in our issues of February, 1897, page 56, and September of the same year, page 322.



Attachment to Four-Wheel Truck.



Showing Attachment of Generator to Six-Wheel Truck.

We are informed that the Santa Fe is now considering the adoption of this light on a much larger scale, and also its use for tail lights on their cars. They have also made tests with it in their Topeka yards for locomotive headlights, the intention being to equip a locomotive with one standard light installation, and besides supplying a powerful incandescent head light for the locomotive and electric light for the cab, provide also, by flexible connection, at least two of the baggage and express cars immediately behind the engine with electric light.

The three postal cars, ordered by the Santa Fe in February to be equipped with this light, are running between Chicago and Kansas City. These cars are equipped with 24 16-candle power lights each, making a total illumination of 380 candle power. These cars stand in the Santa Fe station at Chicago every night from 6 o'clock p. m. until 2.30 a. m., burning full light. They then run to Kansas City, using full light until daylight, arriving there at 2 p. m. the following day, and start immediately on the return trip at 6.20 p. m. of the same day.

The system is now completely organized on the Santa Fe. Every employe of the train service and mechanical department has been furnished with a list of questions and answers on which he is required to pass examination. The inspectors are instructed to examine the countershaft and dynamo bearings whenever the trains are inspected, and if found hot they are required to oil them. Every car carries an extra belt of the exact dimensions required, and if one is lost in transit, the conductor is instructed to telegraph to the nearest station where extra belts are kept, and an employe of the mechanical department replaces it, which, by means of special tools, can be done in about four minutes.

Mr. Max E. Schmidt, President of the National Electric Car Lighting Company, informs us that the company is now placing an equipment on the Long Island Railroad, and that propositions for the introduction of this light are under consideration by the St. Paul & Duluth, the Missouri Pacific, the Canadian Pacific, the Wabash and other Western railroads.

THE "PEERLESS" HOSE SPECIFICATIONS.

The following specifications for air brake hose have been prepared by the Peerless Rubber Manufacturing Company of New York, and are interesting as coming from manufacturers with a good reputation, who are prepared to fulfill the conditions:

"Each standard length of air and signal hose must be branded with the name of the manufacturer, and the year and month in which made, name of road, and a table of raised letters denoting the years and months.

"All air brake and signal hose must be soft and pliable, and not less than four-ply. The tube to be hand-made and so firmly joined to the canvas that it cannot be pulled away without breaking or splitting the tube. The tube, friction, coating and cover to be of the same quality of gum.

"All cotton duck to be used in air brake and signal hose to weigh not less than from 20 oz. to 22 oz. per yard, 38 to 40 inches wide, to be loosely woven and long fiber. Duck must be frictioned on both sides, and in addition to the friction must have a heavy coating of gum on one side, so when made up there will be a distinct layer of gum between each ply of duck. Hose without the coating will be rejected.

"The tube to be not less than 3-32 inches thick. The inside diameter of freight hose must not be more than 1 5-16 inches nor less than 1¼ inches. Outside diameter not more than 2 inches nor less than 1⅞ inches. The inside diameter of passenger and signal hose must not be more than 1 1-16 inches nor less than 1 inch. Outside diameter must not be more than 1¾ inches nor less than 1 11-16 inches. Diameter to be as specified throughout the entire length. All short lengths to have capped ends. All caps must be vulcanized on, not pasted nor cemented on.

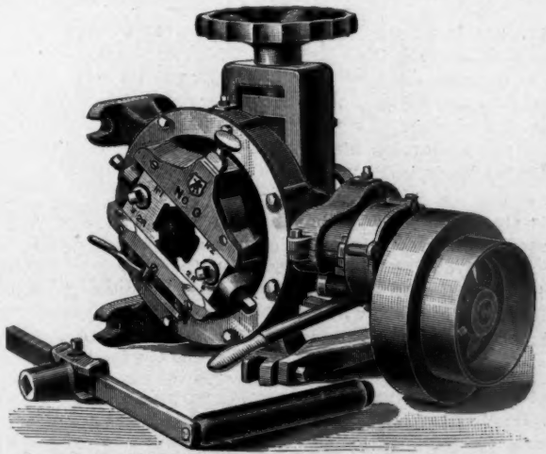
"The friction will be determined by the force required to unwind a section of hose 1 inch in length, the force being applied at the point of separation. With a force of 25 pounds the separation must be uniform and regular, and when unwound from outside to tube the average speed must not be greater than 12 inches in 20 minutes.

"The 1-inch section of the tube or inner lining should then be taken from the piece of 1-inch section used in the friction test, and cut at the thickest part of lap; then marks 2 inches apart will be placed on it and stretched 10 inches from the aforesaid 2-inch marks, and released immediately. It will then be re-marked, and will be stretched 10 inches, or 400 per cent., without breaking, to remain stretched 10 minutes, and to be measured 10 minutes after the strain is removed. In no case must the piece show more than ¼ inch permanent set or elongation in 2 inches. Hose should be at least from three to seven days old before testing.

"All rejected material may be returned, the shipper paying freight both ways."

ARMSTRONG'S PIPE MACHINE WITH POWER ATTACHMENT.

The recognized merit of the No. 9 new hand pipe threading machine, the latest addition of the Armstrong Manufacturing Company to their large line of improved pipe machines, and now in general use, has created a wide demand from mills and factories for the same machine to be run by power. To



Armstrong Pipe Machine with Power Attachment.

meet the demand the Armstrong Manufacturing Company have lately brought out an attachment which can easily be fitted to the machine and turns it at once into a power machine.

This attachment is composed of an extra gear and pinion, with a two-cone pulley, which is slipped on the pinion of the second speed, and has a stay bolted on the base to support it. The engraving shows the machine with attachment ready for the belt. The No. 0 machine is made for threading pipe ⅛-inch to 2 inches and bolts from 1 inch up to 1½ inches. The working parts are all encased so as to keep them free from chips and dust. The gear of the die head does not bear on the head when revolving, and therefore does not wear loose by friction. This is considered the very latest improvement on threading machines, and is intended to make it impossible for the operator to produce a "drunken" thread.

There are other attractive and meritorious features original in this machine, and which have been made to meet the demands of those who use it. Full particulars may be obtained by addressing the manufacturers either at Bridgeport, Conn., or 139 Centre street, New York City.

THE BIG GUN FOR SANDY HOOK.

The ingot for the 16-inch gun to be constructed at the Watervliet Arsenal has been cast at South Bethlehem, and, according to the New York Sun, it will soon be shipped to the arsenal. When finished it will be mounted at Sandy Hook. The gun, which is forty-nine feet long, requires a special 100,000-pound car for its transportation. John F. Meigs, late of the navy, under whose supervision the gun is being built, says that its projectile will weigh about 2,300 pounds, and its velocity will be in the neighborhood of 2,000 feet per second. The range of such a gun would be very great, not less than ten miles, and its extreme range, or the utmost distance to which it could throw a projectile, would be in the neighborhood of fifteen miles.

The nearest approach to this distance heretofore was the so-called jubilee shot in England, where the projectile traveled twelve miles. The gun will be known as a 16-inch, will weigh 126 tons, and will cost $120,000.

THE ADVANTAGES OF STEEL CARS.

Two typographical errors in our article under the above caption at the top of the second column of page 56 of our February issue are brought to our attention by a correspondent who read the article on "Steel Cars of Large Capacity," on page 86 of our March issue. The decimal points are misplaced. The cost per year per ton capacity for the wooden car should read $3.61, instead of $36.11, and the corresponding cost for steel cars should read $2.36, instead of $23.66. The mistake is so evident that we hope readers will not be confused by it.

EQUIPMENT AND MANUFACTURING NOTES.

LOCOMOTIVES.

The H. K. Porter Co., Pittsburg, Pa., has recently shipped two locomotives to the Great National Mexican Smelting Co. of Monterey, Mex.

The Delaware & Hudson Canal Co. has placed an order with the Dickson Locomotive Works for two mogul engines, one simple and one Dean compound.

The Rogers Locomotive Co. of Paterson, N. J., is building one locomotive for the Illinois Central and four locomotives for the Toledo, Peoria & Western.

The Richmond Locomotive & Machine Works have received the order for one compound and one simple locomotive and five spare boilers, for the Chicago Great Western.

The Brooks Locomotive Works will build the following locomotives: 30 for the Great Northern, two six-wheel switching engines for the Peoria & Pekin Union, eight locomotives for the Washington County road.

The Schenectady Locomotive Works have received orders for 20 locomotives for the Chicago & Northwestern Railway. Ten are duplicates of 18 by 24 inch, six-wheel switching engines and the others are duplicates of 19 by 26 inches 10-wheel freight engines, like those illustrated on page 407 of our issue of December, 1897. These builders also have orders for 10 19 by 24 inch 10-wheel freight engines and one 19 by 24 inch passenger engine for the Chicago, St. Paul, Minneapolis & Omaha Ry., for one locomotive for the Midland Terminal Railroad; also for 12 16 by 24 inch 8-wheel locomotives for the Kiushiu Railway of Japan, being a duplicate of a similar order received last fall.

The Baldwin Locomotive Works will build the following engines: Three for the Sorocabana & Ituana Railroad, two switching engines for the Kansas City Belt, 14 engines for the Russian State railroads, 20 for the Ribinsk-Moscow-Windau Railway, two six-wheeled switching locomotives for the Indianapolis Union, two locomotives for the West Virginia Central & Pittsburg, one six-wheel switching engine for the Cambria Iron Co., five engines for the Canadian Pacific, one en-

gine for the Kansas City, Pittsburg & Gulf, four moguls and one American type locomotive for Fort Worth & Rio Grande, one passenger engine for the Dominion Atlantic, one engine for the Florence & Cripple Creek Railroad, one switching locomotive for the National Docks Railroad, 10 10-wheel engines for the Ottawa, Arnprior & Parry Sound Railroad, and 15 heavy mogul freight engines for the Egyptian State Railways.

CARS.

The Ensign Mfg. Co. is building 150 cars for the Ohio River Railroad.

The Erie Car Works are building three cars for the Nichols Chemical Co.

The Elmira Bridge Co. will build 20 Goodwin cars for the Goodwin Car Co.

The Wells & French Co. are building 10 refrigerator cars for the Wolff Packing Co. of Topeka, Kan.

The Kansas City Car & Foundry Co. will build 100 refrigerator cars for the Armour Packing Co.

The Union Car Co. have received orders to build 100 flat and 150 box cars for the Washington County Road.

The Lima Locomotive & Machine Co. has received an order to build 500 coal cars for the Wheeling & Lake Erie.

The Haskell & Barker Car Co. are building 250 flat cars and 50 stock cars for the Chicago, Indianapolis & Louisville.

John Hamond & Co. of San Francisco will build one passenger and 40 freight cars for the McCloud River Railroad.

Rhodes, Curry & Co., Ltd., of Amhurst, N. S., are building 50 new box cars for the Intercolonial Railway of Canada.

The Ohio Falls Car Co. are building eight passenger cars for the New York, Ontario & Western, 200 coal cars and three cabooses for the Chicago & Southeastern.

The St. Charles Car Co. will build 200 stock cars of the Mather pattern for the St. Louis Southwestern, and two passenger cars for the St. Louis, Peoria & Northern.

The Missouri Car & Foundry Co. are building 150 furniture cars for the Union Pacific, 300 stock cars of the Mather pattern for the St. Louis Southwestern and 10 freight cars for the Shreveport, Red Wing & Southern.

The Michigan Peninsular Car Co. have orders for the following cars—12 for the Oahu Railroad & Land Co. of Hawaii, 500 box and 500 stock cars for the Union Pacific, 100 furniture cars for the Chicago, Rock Island & Pacific.

The Jackson & Sharp Co. of Wilmington, Del., have recently shipped five sleeping cars to Rosario for the Argentine Great Western Railroad. This concern is building one passenger car for the Narragansett Pier Railroad.

The Pullman Palace Car Co. will build two dining cars and four cafe cars for the Chicago, Rock Island & Pacific, 10 freight cars for the Richmond, Fredericksburg & Potomac, and 200 flat cars for the Kansas City, Pittsburgh & Gulf.

The Illinois Car & Equipment Co. will build the following cars: 50 60,000-lb. cars for the Mobile & Birmingham, 50 flat cars for the Kansas City, Fort Scott & Memphis, 250 box cars for the Rio Grande Western and 25 ore cars for the Spokane Falls & Northern.

MISCELLANEOUS.

The Pratt & Whitney Company of Hartford are working day and night to turn out machinery for making rapid-fire machine guns.

A new Union Station for Pittsburg is being planned. It will be on the site of the present one, and will cost $3,000,000. The tracks will be elevated.

Messrs. Manning, Maxwell & Moore have received an order for a 72-inch Pond planer for the Davis-Egan Company. The planer will have four heads and a 40-foot table.

Magnesia Sectional Covering, furnished by the Keasbey & Mattison Co. of Ambler, Pa., was furnished for the steam motor car built by the Schenectady Locomotive Works for the Erie

Japan is reported to be about ready to order material and equipment for a large foundry to be built and operated by the government, the amount of foreign orders for which will be about $2,250,000.

The Bushnell Manufacturing Company, manufacturers of car seats for steam, elevated, electric and cable railroads, have opened an office at 43 Cedar street New York, where all correspondence should be addressed to Mr. E. M. Bushnell, Vice-President of the company.

The Edward P. Allis Company, of Milwaukee, has an order for six vertical cross-compound condensing engines, with cylinders 46x86 in. by 60 in. stroke, for the Metropolitan Street Railway of New York. The engines will weigh about 1,000,000 pounds each, and it will require over 125 freight cars to transport the six engines to New York.

The buildings at the works of Messrs. Siemens & Halske, in Charlottenburg, Germany, occupy nearly 270,000 square feet of ground, and the number of employees is 4,000. There are 1,366 machine tools in the shops driven by shafts and belting, while 444 others are driven by direct connected electric motors. There are 472 electric motors in regular use at these works.

The Baltimore & Ohio Southwestern Railway Co. has changed its dining car system from the table d'hote to the a la carte plan with the result of increased profits, better service and greater satisfaction on the part of patrons. The cars are open for business during the entire time they are on the train, and the innovation seems to have met with the approval of the passengers.

Car curtains in the form of roller shades with a leather-like surface upon one side and a textile fabric on the other are being introduced by the Pantasote Company to replace slatted blinds. This material is impervious to moisture and not affected by rain or sponging, heat or frost. It does not fade, shrink or stretch, and is especially adapted to car seats, for which it has for a long time been used.

A belt dressing that prevents slipping and preserves the life of the leather is offered by the Joseph Dixon Crucible Co. of Jersey City, N. J. Belts are usually tightened on the first appearance of the slipping, and tight belts are known to wear rapidly. This dressing has had a good and a long record, having been used at the Paris Exposition in 1878 on the chief belt in the machinery department at that exhibition.

There are large tracts of coal lands near Meyersdale, Pa., on the Baltimore & Ohio Railroad which capitalists are beginning to develop. A new road about five miles long has been pushed into this region and will soon be ready for operation. It is one of a number of small lines that are being built by outside parties to develop hitherto inaccessible tracts of both coal and timber lands in Pennsylvania and West Virginia.

It is stated on good authority that the C., M. & St. P. Ry. will soon change certain of its suburban lines to electric traction. The Evanston division has been the subject of considerable investigation in this connection, and the plan likely to be adopted is to connect with the Northwestern Elevated, which will bring the suburban line in direct communication with the city streets by means of the Union Loop. This would be an ideal plan.

Mr. D. M. Brady, of the Brady Metal Company, informs us that his company furnished the Magnus Metal bearings for the cars and engines used in the fast newspaper train which ran from Jersey City to Buffalo over the Erie Railroad on Saturday, February 15, a distance of 425 miles, in 426 minutes of actual running time. He also states that Magnus metal is now in use on 6,827 locomotives and 235,242 cars in various parts of the world.

A new boiler, called the Paragon boiler, especially designed for yachts, tugs and canal steamers, has just been patented in the United States and Canada by Capt. M. DePuy, 19 South street, New York. Its claims are for specially good circulation and favorable arrangement of heating surface, as well as sim-

plicity of construction and accessibility for cleaning and repairs. The inventor has had a long experience with marine boilers, and has used it in this design.

The cars for the two new express trains for the Chicago, Milwaukee & St. Paul Ry., now building by the Barney & Smith Car Company, will be equipped with the Two-Coil, Jointless Steel, Fire Proof Baker Heater. Mr. Baker reports that he has just furnished 28 Single-Coil Fire Proof Heaters for the Great Northern Railroad's new cars, building by the same firm. The Louisville & Nashville, Missouri Pacific and Pennsylvania lines have also been liberal buyers of his fire proof heaters during the last few months.

The Baltimore & Ohio Railroad has purchased 10,000 tons of 80-pound steel rails for the lines west of the Ohio River. The order will be divided between the Central Ohio, the Chicago and the Lake Erie Divisions, and will make that portion of the system a fit companion for the lines east of the Ohio, which are rapidly being placed in the best shape. About 15,000 tons of the 40,000 bought last Summer for the main line will be placed in the tracks this Spring, giving the Baltimore & Ohio new rail from the Ohio River to tidewater.

The Page Woven Wire Fence Company at Ontario has recently received orders for 200 miles of fence for use on the Atlantic & Lake Superior Railway, for 42 miles on the Pembroke Southern, and for a carload for the Intercolonial Railway. The Niagara Cataract and Power Company has also ordered a carload. Beside these orders regular requisitions from railroads amount to several times as much, and the farm trade is also very large and growing rapidly. The order for the Atlantic & Lake Superior road amounts to about 30 carloads of fencing.

The Keasbey & Mattison Co., of Ambler, Pa., furnished a large amount of steam pipe covering to the Boston & Maine Railroad for the new shop plant at Concord, N. H., as described elsewhere in this issue. In this order there were coverings for 1,047 feet of 1½ inch pipe, 627 feet of 2 inch, 432 feet of 2½ inch, 780 feet of 4 inch, 534 feet of 5 inch, 792 feet of 6 inch, 111 feet of 8 inch, 6 feet of 10 inch, and 42 feet of 12 inch pipe, in all making over 4,000 linear feet of steam piping covered with "Magnesia Sectional Covering." It is doubtful whether there is a better investment than this in the entire plant.

M. Soulecroup, Assistant Superintendent of Motive Power of the Paris and New Orleans Railroad, and a corps of five assistants, have been inspecting the electrical plant of the Baltimore & Ohio Railroad at Baltimore very closely. The work being done by the electric motors in the Belt Line tunnel has attracted attention all through Europe, and M. Soulecroup's visit to this country was for the express purpose of investigating the ways and means operation. The Paris & New Orleans Railroad is to be an underground line running from one of the suburbs of Paris to the centre of the city, and it is quite probable that it will be equipped with electric motors similar to those used in the Baltimore line, except that they will be much smaller.

The increase in the business of the Sargent Company has shown such an advance over that of the first three months of last year, about 40 per cent., as to make it imperative to increase the capacity of the plant considerably. They have recently installed a large twenty-ton electric traveling crane from Manning, Maxwell & Moore, in addition to the cranes now operated, and an additional saw of the latest and most improved type, manufactured by the Q & C Co., and in their receiving and shipping departments, their capacity has been greatly increased. In the power house, new engines, dynamos, etc., are about to be installed. The works now have a capacity of about 1,000 tons a month, which will, of course, be greatly increased by the changes now in process.

Thirty-one thousand tons of steel rail, ranging in weight from 75 to 85 lbs. to the yard, will be placed in the B. & O. tracks this spring. It is expected that the work will begin by April 1 and be completed within three months. Twenty-one thousand tons will be laid east of the Ohio River, and forms part of the 40,000 tons purchased last Summer, the balance being the 10,000-ton lot recently bought by the receivers for west of the Ohio River. This new rail will be laid on divisions where the traffic is very heavy. It has been found that about 60 per cent. of the old road is in good condition for portions of the line where light rolling stock is used, and it will be used to replace the rail now in service on these parts of the road. When all this rail is laid there will be a new double track from Grafton to Baltimore.

In a set of rules or specifications for steam piping recently compiled by the mechanical engineer of a large railroad system for the guidance of those who install such works on the road, the following occurs: "Use only best grades of packing. We are using 'Rainbow,' which is undoubtedly the best." These specifications were intended only for use by men on the road, but a representative of this paper was allowed to see them. "Rainbow" packing was described on page 335 of our issue of October, 1897, in connection with other products of the works of the Peerless Rubber Manufacturing Company, who manufacture this packing. "Rainbow" packing was used on all the flange connections in the extensive piping system at the Concord shops of the Boston & Maine R. R., of which a description is given elsewhere in this issue.

The Baltimore & Ohio Railroad Company has improved its freight facilities in Philadelphia very materially during the past year. A new pier, known as No. 22 South, which was completed last December, is 557 feet long and 140 feet wide, and is said to be one of the finest in the city. Vessels of the deepest draught can tie up on both sides of the pier, thereby affording every facility for the prompt handling of freight. The pier and sheds are lighted with improved incandescent lights, and well-paved driveways have been provided. This improvement enables the B. & O. to handle about three times as much business as formerly. The different freight yards throughout the city have been improved by the laying of additional tracks, and arrangements have been made with the Pennsylvania Warehousing and Safe Deposit Company by which the B. & O. handles grain, flour, hay, straw, canned goods, and other merchandise, through their warehouses and elevators.

O'Neill Brothers, manufacturers of wool waste, Columbia avenue and Putnam street, Philadelphia, in noting the article on "Lubrication of Driving Journals," on page 97 of our March issue, call our attention to the importance of using good packing in journal boxes. Many railroads pay too little attention to this, and it is believed that much of the trouble with hot boxes may be avoided by improvement in this direction. We have been allowed to see the following letter, written to Messrs. O'Neill by a prominent railroad man, whose name we are not at liberty to print: "Referring to your letter of 23d ult. following report from our Master Mechanic concerning wool waste furnished by you: 'Replying to your favor of November 29th, and returning herewith all correspondence, beg to advise that the wool waste received recently from O'Neill Brothers, of Philadelphia, is at present giving good satisfaction. We have used part of it in our passenger coaches and some on our engines, and it has given no trouble at all."

The Pancoast Ventilator Company, Philadelphia, writes that since they have equipped the West Virginia, Central & Pittsburgh, Cumberland, Md., round-house with their ventilators, or smokestacks, they have had a large number of requests from prominent railroad officials for information and tracings that will show their improved device. It has proved so satisfactory to the above company that Mr. Henvis, the president, has been requested by a prominent chief engineer to visit the round-houses of his road, with the view of having the "Pancoast" used in the place of a large number of so-called ventilators now in use on their buildings, stating that the damage to locomotives in a year will pay for ventilators of a proper kind many times over. We are glad that this important matter is being appreciated. Round-house smokestacks will form the subject of an investigation and report by a committee of the Association of Railway Superintendents of Bridges and Buildings at the next meeting, to be held at Richmond, Va., Oct. 18, 1898.

The Bacon Air Lift Company, until recently with the Blake Pump Manufacturing Company, Liberty St., New York, is now occupying very handsome offices on the twentieth floor of the American Surety Building, 100 Broadway. The change was made necessary by the rapidly increasing business. Among the men prominently identified with the company are: Mr. J. E. Bacon, who has made a special study of water supply problems for several years, during which time he has had occasion to inspect and install a large number of air-lift pumps; Mr. George R. Young, who for a long time was identified with the Knowles Steam Pump Works, and who is possessed of a practical knowledge and experience in the matter of pumping systems; Mr. John T. Gibson, late of the Blake Manufacturing Company, a specialist in all classes of pumping machinery. Mr. Clifford Shaw is to superintend the construction department, and is fitted for the work by a wide experience. The company has secured the patents of Mr. Young and Mr. Shaw, which cover valuable improvements in air-lift pumps, greatly increasing the field in which such pumps may be used, and lessening the cost of operation considerably.

Our Directory

OF OFFICIAL CHANGES IN MARCH.

Aransas Harbor Terminal.—Chief Engineer W. D. Jenkins has moved his office from Tarpon, Tex., to Aransas Pass, Tex.

Chicago, Burlington & Quincy.—Mr. George G. Yeomans has been appointed Purchasing Agent, with headquarters at Chicago, Ill., to succeed Mr. George Hargreaves, resigned.

Chicago Junction.—Mr. F. T. Craxow has been appointed Purchasing Agent.

Choctaw, Oklahoma & Gulf.—Mr. James Cunningham, Master Mechanic, has transferred his office from South McAllister to Shawnee, I. T.

Cincinnati Northern.—Mr. Frank B. Drake has resigned as General Manager, and the office has been abolished.

Cleveland, Cincinnati, Chicago & St. Louis.—Mr. A. M. Stimson, Purchasing Agent, died at his home in Lafayette, Ind., March 8, after a brief illness.

Columbia & Western.—Mr. T. G. Shaughnessy, Vice-President of the Canadian Pacific, has been elected President of the Columbia & Western.

Connecticut River.—Mr. John Mulligan, President of this road, died at his home in Springfield, Mass., February 21, at the age of 78 years.

Cornwall.—Mr. C. G. Herman of Philadelphia, Pa., has been appointed Master Mechanic, with headquarters at Lebanon, Pa., succeeding Mr. A. J. Reed. Mr. Herman was formerly with the Baldwin Locomotive Works.

Detroit & Lima Northern.—Mr. A. Mitchell, who has been Chief Engineer in charge of the extension of this road, has resigned, and is succeeded by Mr. Frank Mitchell.

East Tennessee & Western North Carolina Railroad.—Mr. R. F. Hoke is President and Mr. F. Firmstone Vice-President of this company.

Findlay, Ft. Wayne & Western.—Mr. C. M. Bissell, General Manager of this road, is reported to have tendered his resignation, to take effect April 1.

Fonda, Johnstown & Gloversville.—Mr. James Pierson Argersinger, Director and Vice-President, died at his home in Johnstown, N. Y., March 11, at the age of 64.

Fort Worth & Denver City.—Col. Morgan Jones, heretofore Vice-President, has been elected Vice-President and General Manager.

Fulton County Narrow Gauge.—Mr. W. G. Sharretts has been appointed Superintendent, with headquarters at Lewistown, Ill., in place of Mr. A. C. Atherton, resigned.

Hutchinson & Southern.—This road has been reorganized and Mr. W. A. Bradford, Jr., formerly General Manager, has been elected President. Mr. L. E. Walker, formerly Receiver, has been elected Vice-President and General Manager.

Kansas City, Watkins & Gulf.—Mr. H. B. Kane has been appointed Receiver, with office at Lake Charles, La.

Leavenworth, Kansas & Western.—Mr. B. R. Brandow of Leavenworth, Kan., has been appointed Master Mechanic. His office will be located at Leavenworth, Kan.

Lebanon, Sodaville & Waterloo.—Mr. M. W. Wilkins of Waterloo, Ore., is President and General Manager.

Lehigh Valley.—The General Traffic Offices, now at Philadelphia, will be transferred on May 1 to New York City. Offices will be opened in the Havemeyer Building, in Cortlandt street. Mr. E. P. Mooney has been appointed Master Mechanic of the Buffalo Division, with headquarters at Buffalo, N. Y., succeeding Mr. John Campbell, recently resigned. Mr. Mooney has been acting as Road Foreman of Engines and Traveling Engineer of the Buffalo Division for six years. Mr. Alvin C. Smith of Buffalo has been appointed to succeed Mr. Mooney.

Lehigh Valley.—Mr. Robert H. Sayre has been appointed Assistant to the President. He was formerly Second Vice-President of this road. Mr. J. B. Garrett has been appointed Second Vice-President. He was formerly Third Vice-President.

Minneapolis & St. Louis.—Mr. Howard G. Kelley has been appointed Chief Engineer, with headquarters at Minneapolis, Minn. He was formerly Chief Engineer of the St. Louis Southwestern.

Mississippi River, Hamburg & Western.—Mr. A. M. Gibson has been appointed Chief Engineer, with headquarters at Portland, Ark.

Mobile & Ohio.—Mr. E. L. Russell has been chosen President; he was formerly First Vice-President. He succeeds Mr. James C. Clarke, resigned. Mr. Richard Carroll has been appointed Vice-President and General Manager, succeeding Mr. J. G. Mann as General Manager, Mr. Mann having been appointed Chief Engineer. Mr. W. A. Stone has been appointed Master Mechanic of the Montgomery Division of this road. He was formerly Master Mechanic of the Southern Railway at Selma.

New York, New Haven & Hartford.—Mr. F. B. Smith, who has heretofore had the title of Master Mechanic, has been given the title of General Master Mechanic. His headquarters are at New Haven, Conn.

Pacific Coast.—Mr. H. H. Durand has been elected President and Mr. Wm. H. Porter has been elected Vice-President, with headquarters at New York.

Omaha, Kansas City & Eastern.—Mr. W. A. Williams has been appointed General Superintendent, with headquarters at Quincy, Ill. He was formerly Superintendent of the Northern Division of the Kansas City, Pittsburg & Gulf.

Peoria & Pekin Union.—At the annual election held at Peoria, Ill., March 8, Mr. George L. Bradbury, Vice-President and General Manager of the Lake Erie & Western, was elected President and General Manager of the Peoria & Pekin Union. Mr. C. H. Bosworth was elected Vice-President and General Superintendent, with office at Peoria, Ill.

Rome & Carrollton.—Mr. C. B. Wilburn has been appointed Receiver. He is also President of the Chattanooga, Rome & Southern.

Santa Fe Pacific.—Mr. Richard English has resigned as General Master Mechanic.

Seattle & International.—Mr. L. S. Miller has been appointed Assistant to the President, with headquarters at Seattle, Wash. He was formerly Assistant General Manager of the St. Paul & Duluth.

Southwestern Alabama Railway.—Mr. S. G. McLendon has been elected President, with office at Thomasville, Ga.

St. Louis Southwestern Railway.—Mr. H. G. Kelley has resigned as Chief Engineer, and the office has been abolished.

St. Louis, Avoyelles & Southwestern.—Mr. W. H. Peterman has been appointed Receiver. He was formerly President of this road.

St. Paul & Duluth.—Mr. C. J. A. Morris has been appointed Chief Engineer, with headquarters at St. Paul, Minn. Mr. Morris has heretofore been Chief Engineer of the Northwestern Coal Railway at St. Paul.

Tacoma & Columbia River.—Mr. W. C. Halliday has been appointed Chief Engineer, with headquarters at Tacoma, Wash.

Texas Central.—Mr. Richard Oliver, Secretary and Treasurer, has also been appointed General Manager, vice Mr. Charles Hamilton, who still continues as Vice-President.

Union Pacific.—Mr. T. A. Davies, Master Mechanic of the Wyoming Division of this road, has removed his office from Laramie to Cheyenne, Wyo.

Walterboro & Western.—Mr. C. S. Gadsden has been elected President.

Washington & Columbia River.—Mr. Joseph McCabe, formerly Superintendent of the Pacific Division at Tacoma, Wash., has been appointed General Manager, with headquarters at Walla Walla, Wash., succeeding Mr. W. D. Tyler, recently resigned.

Wilkesbarre & Northern.—Mr. John Graham of Philadelphia, Pa., was elected President and General Manager, succeeding Mr. John B. Reynolds of Kingston, resigned.

Wiscasset & Quebec.—Mr. W. Fred P. Fogg has resigned as General Manager, and Mr. William D. Patterson, Treasurer, has been appointed Acting General Manager, with headquarters at Wiscasset, Me.

WANTED.

A capable locomotive draftsman for a railroad position. Applicants must have good training in theory and some years of experience in drawing office on locomotive work, shop experience very desirable. A promising position for an industrious and capable man. Address "Draftsman," care American Engineer, 140 Nassau St., N. Y.

WANTED.

A practical car draftsman, capable of working out details of freight cars and making finished drawings of all kinds of freight equipment. State age, experience and salary expected. Address X. Y. Z., care American Engineer, 140 Nassau, St., N. Y.